



# **4-Bit Micro-Controller**

**Introduction to all the clock modes  
in the TM87 series**

## **Application Note**

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# INDEX

**PRODUCT NAME ..... 2**  
    **SZ062\_01 ..... 2**

**APPLICATION NOTE ..... 2**

**I. Fast only mode ..... 2**

        1. Using external ceramic resonator ..... 2

        2. Using the external resistor to generate oscillation..... 3

        3. Using internal RC oscillation, choose 250KHz or 500KHz ..... 6

**II. Slow only mode ..... 9**

        1. Using the external 32.768KHZ Quartz crystal oscillator ..... 9

        2. Using external RC to couple the XIN and the XOUT to generate oscillation ..... 10

**III. Dual Clock mode ..... 16**

**PRODUCT NAME**

**SZ062\_01**

**TITLE**

**Introduction to all the clock modes in the TM87 series**

**APPLICATION NOTE**

We can use mask option to choose the clock sources. There are three clock sources to choose from for the TM87 series MCU. Fast only, Slow only and Dual clock.

**I. Fast only mode**

- There are three clock sources to choose from in the Fast only mode: the first one is to use an external ceramic resonator, the second is to use external resistor to generate oscillation, and the third is to use internal RC oscillation (choose 250KHz or 500KHz).
- In the Fast only mode, the clock signals generated by the fast clock oscillator can be used as the basic frequency for the circuitries such as the system clock generator, pre-Divider, timer, I/O chattering prevention and LCD driver module etc.
- When the MCU executes the STOP instruction and enters the STOP mode, the fast clock oscillator will be disabled and stop oscillating.

**1. Using external ceramic resonator**

- Do not use the 3.58 MHz ceramic resonator in the 1.5V Ag battery mode.
- Set the BCF flag to 1 before enable 3.58MHz ceramic resonator in the 3V Li battery mode.

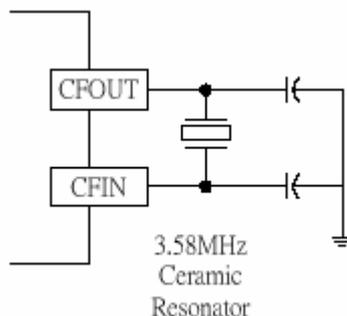
For TM8726 example & Mask Option Program :

2.CLOCK SOURCE :

A.FAST ONLY       .SLOW ONLY       .DUAL

33.FAST CLOCK TYPE FOR ONLY OR DUAL :

A.INTERNAL RESISTOR FOR 250KHz       .INTERNAL RESISTOR FOR 500KHz  
 .EXTERNAL RESISTOR       .3.58MHz CERAMIC RESONATOR



2. Using the external resistor to generate oscillation

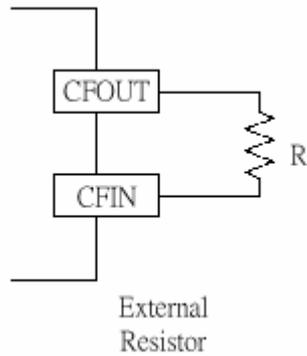
For TM8726 example & Mask Option Program :

2.CLOCK SOURCE :

- A.FAST ONLY
- .SLOW ONLY
- .DUAL

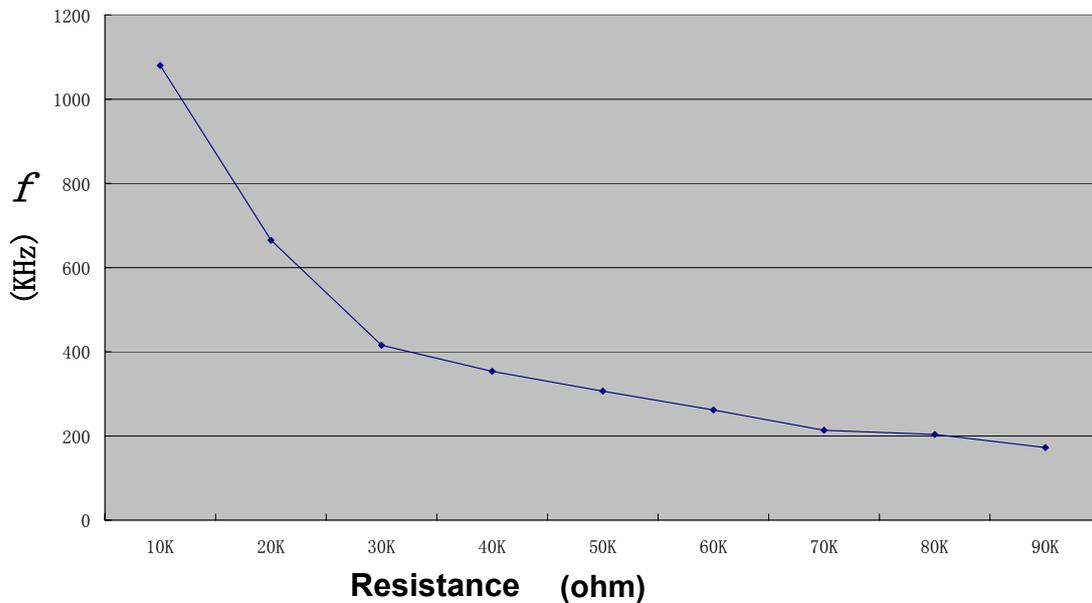
33.FAST CLOCK TYPE FOR ONLY OR DUAL :

- A.INTERNAL RESISTOR FOR 250KHz
- .EXTERNAL RESISTOR
- .INTERNAL RESISTOR FOR 500KHz
- .3.58MHz CERAMIC RESONATOR

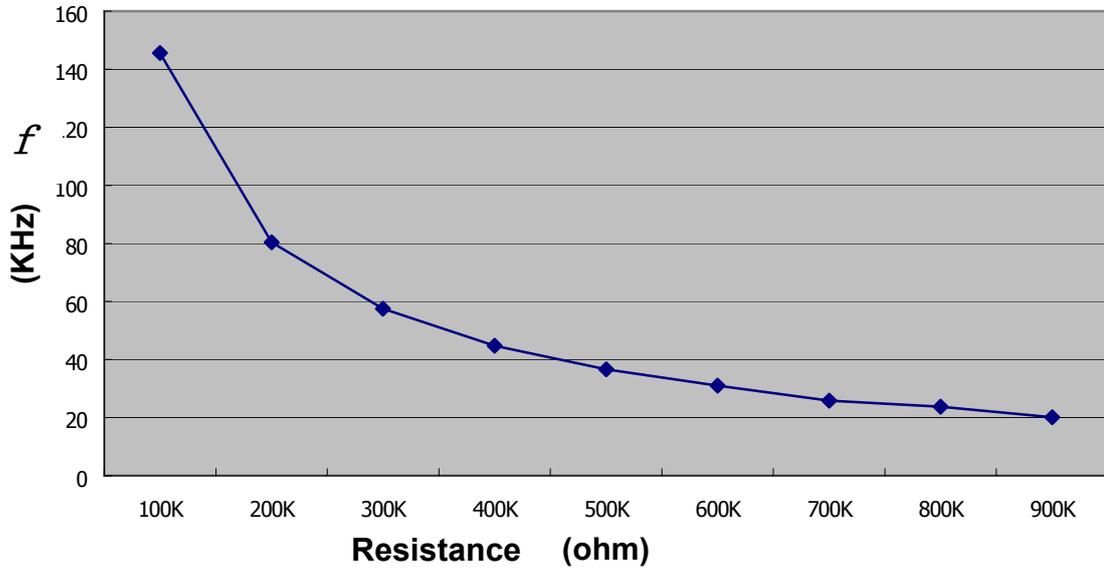


- When using the external resistor to generate oscillation in 3V operating application, the resistance and frequency relation chart will be:

TM8726 3.0V fast Ext-R R vs F

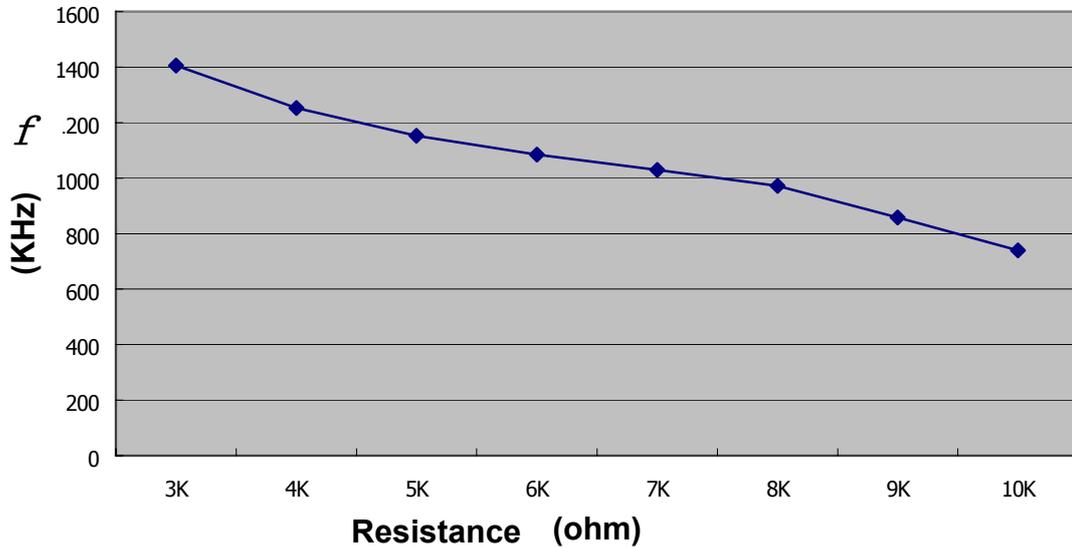


TM8726 3.0V fast Ext-R R vs F

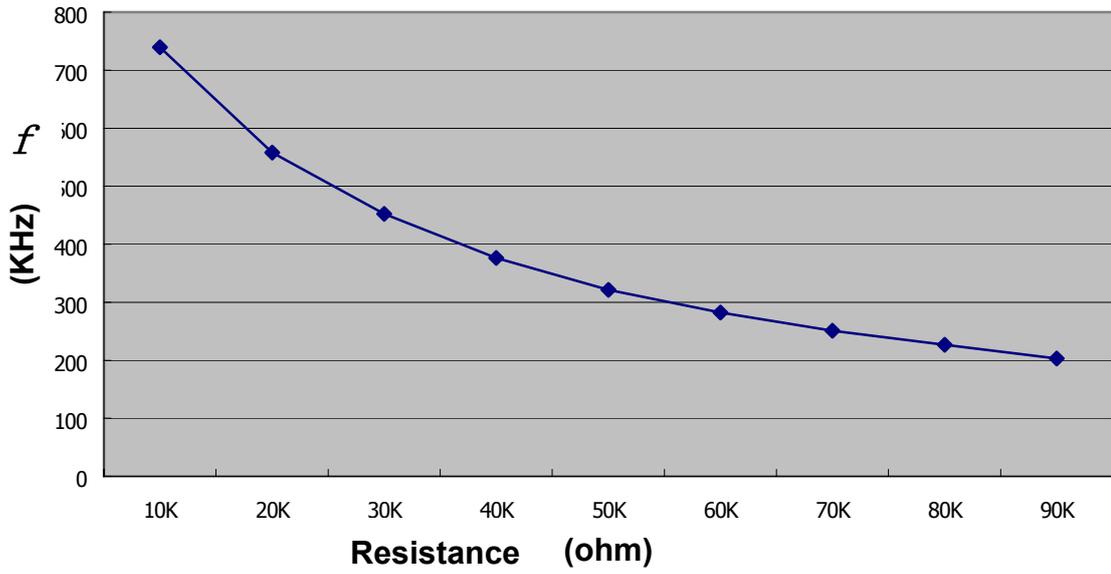


- When using the external resistor to generate oscillation in 1.5V operating application, the resistance and frequency relation chart will be:

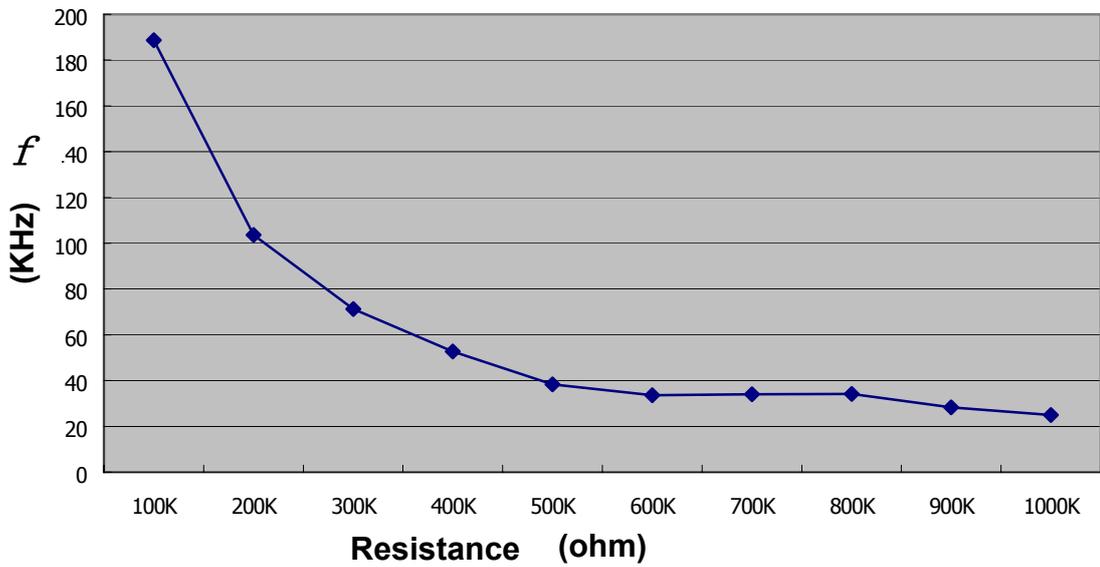
TM8726 1.5V fast EXT-R R vs F



TM8726 1.5V fast EXT-R R vs F



TM8726 1.5V fast Ext-R R vs F



3. Using internal RC oscillation, choose 250KHz or 500KHz

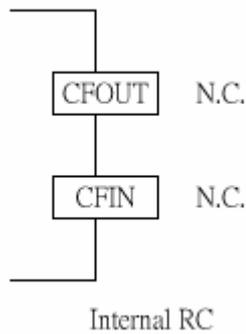
For TM8726 example & Mask Option Program :

2.CLOCK SOURCE :

- A.FAST ONLY
- .SLOW ONLY
- .DUAL

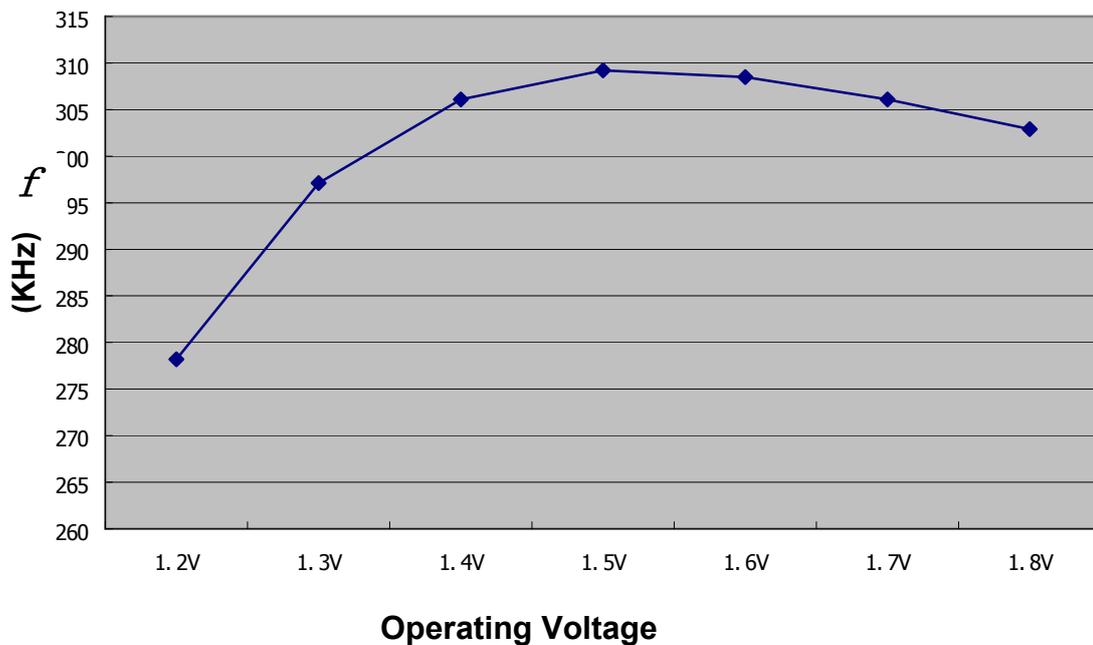
33.FAST CLOCK TYPE FOR ONLY OR DUAL :

- A.INTERNAL RESISTOR FOR 250KHz
- .EXTERNAL RESISTOR
- .INTERNAL RESISTOR FOR 500KHz
- .3.58MHz CERAMIC RESONATOR



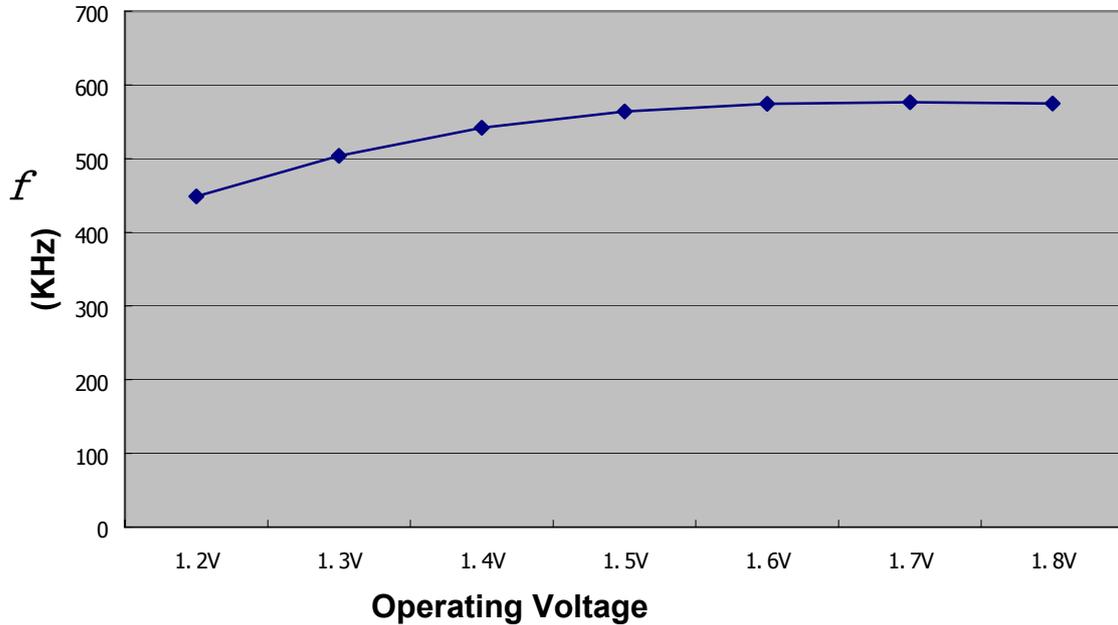
- When using the internal RC oscillation in 1.5V operating application, the operating voltage and frequency relation chart (choose 250KHz) will be:

TM8726 1.5V Int-250KHz F vs V



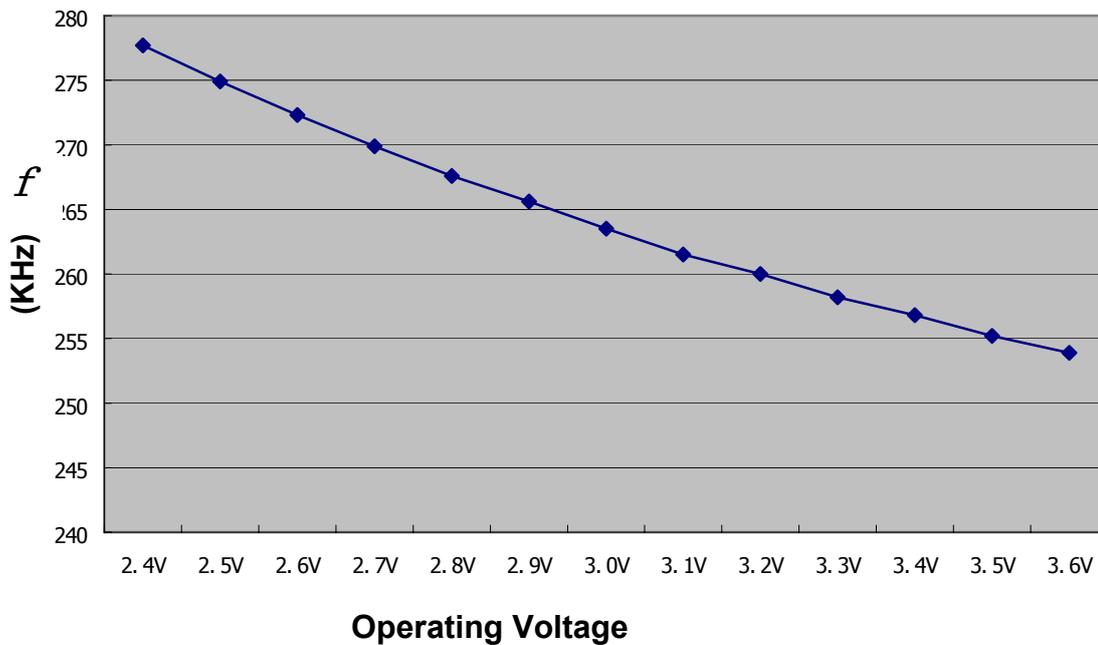
- When using the internal RC oscillation in 1.5V operating application, the operating voltage and frequency relation chart (choose 500KHz) will be:

TM8726 1.5V Int-500KHz F vs V



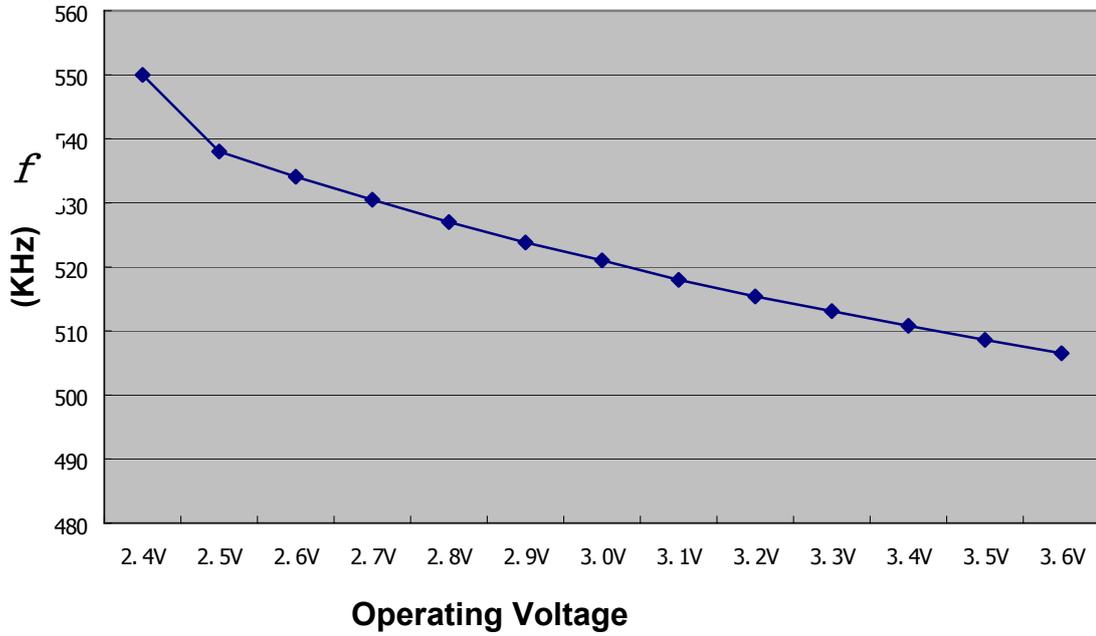
- When using the internal RC oscillation in 3V operating application, the operating voltage and frequency relation chart (choose 250KHz) will be:

TM8726 3.0V Int-250KHz F vs V



- When using the internal RC oscillation in 3V operating application, the operating voltage and frequency relation chart (choose 500KHz) will be:

TM8726 3.0V Int-500KHz F vs V



II. Slow only mode

- There are two clock sources to choose from in the Slow only mode: one is to use the external 32.768KHZ Quartz crystal oscillator and the other is to use external RC to couple the XIN and XOUT to generate oscillation.
- In the Slow only mode, the clock signals generated by the slow clock oscillator can be used as the basic frequency for the circuitries such as the system clock generator, pre-Divider, timer, I/O chattering prevention and LCD driver module etc.
- When the mask option is set to Fast only mode, the slow clock oscillation module will be disabled permanently.
- When the MCU execute the STOP instruction and enters the STOP mode, the slow clock oscillation module will be disabled and stop oscillating.

1. Using the external 32.768KHZ Quartz crystal oscillator

- When the BCF flag is set to 1, the crystal oscillator will produce higher driving capability to sustain the oscillation, but it will consume higher current.

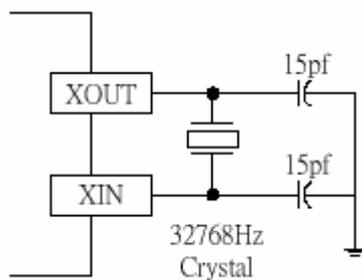
For TM8726 example & Mask Option Program :

2.CLOCK SOURCE :

A.FAST ONLY       .SLOW ONLY       .DUAL

32.SLOW CLOCK TYPE FOR ONLY OR DUAL :

A.X'tal       .RC



2. Using external RC to couple the XIN and the XOUT to generate oscillation

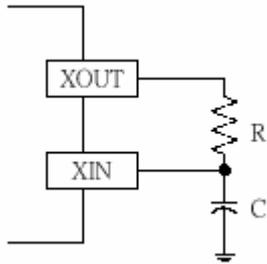
For TM8726 example & Mask Option Program :

2.CLOCK SOURCE :

- A.FAST ONLY
- .SLOW ONLY
- .DUAL

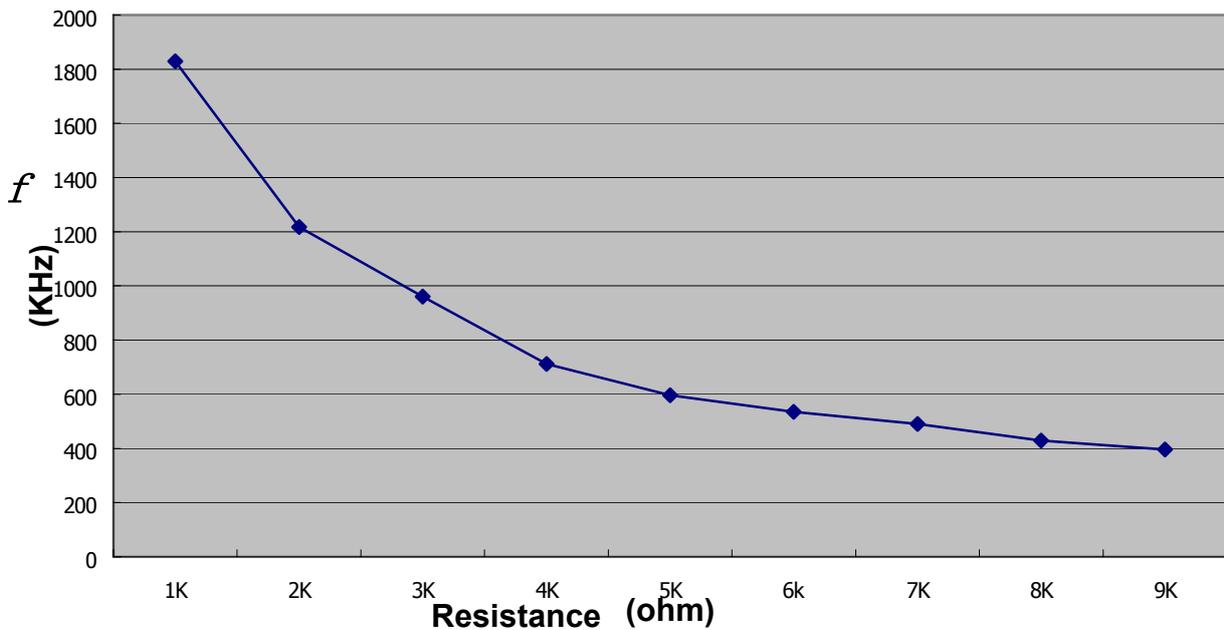
32.SLOW CLOCK TYPE FOR ONLY OR DUAL :

- A.X'tal
- .RC

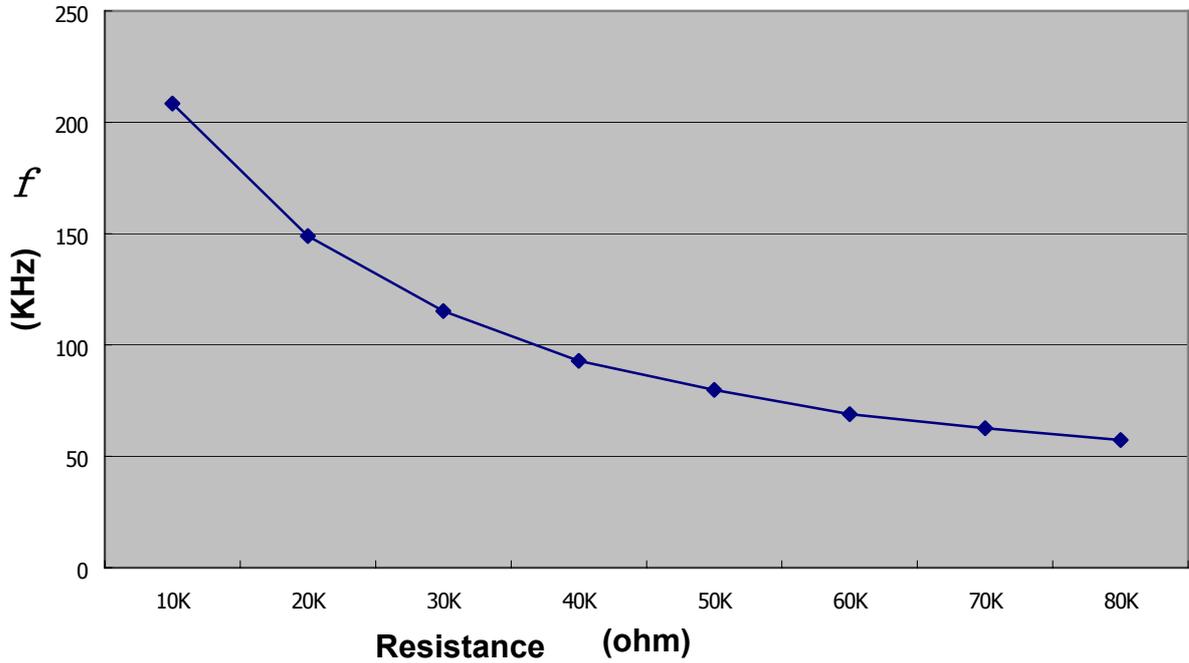


- When using the external RC oscillation in 1.5V operating application, the resistance and frequency relation chart (capacitance 100pF) will be:

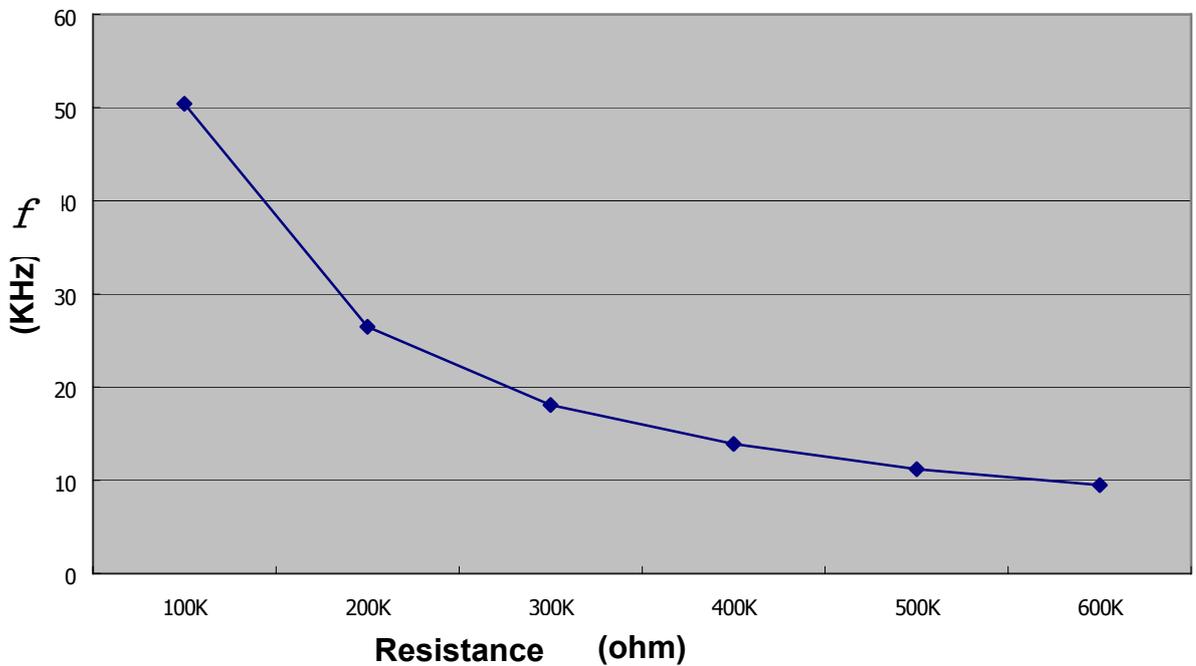
TM8726 1.5V slow RC R vs F (C=100pF)



TM8726 1.5V slow RC R vs F (C=100pF)

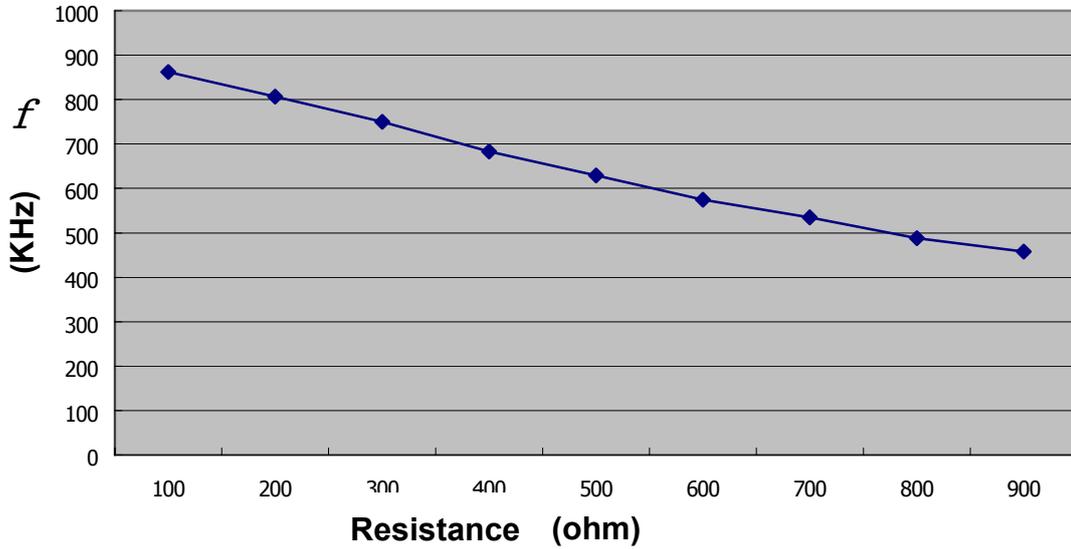


TM8726 1.5V slow RC R vs F (C=100pF)

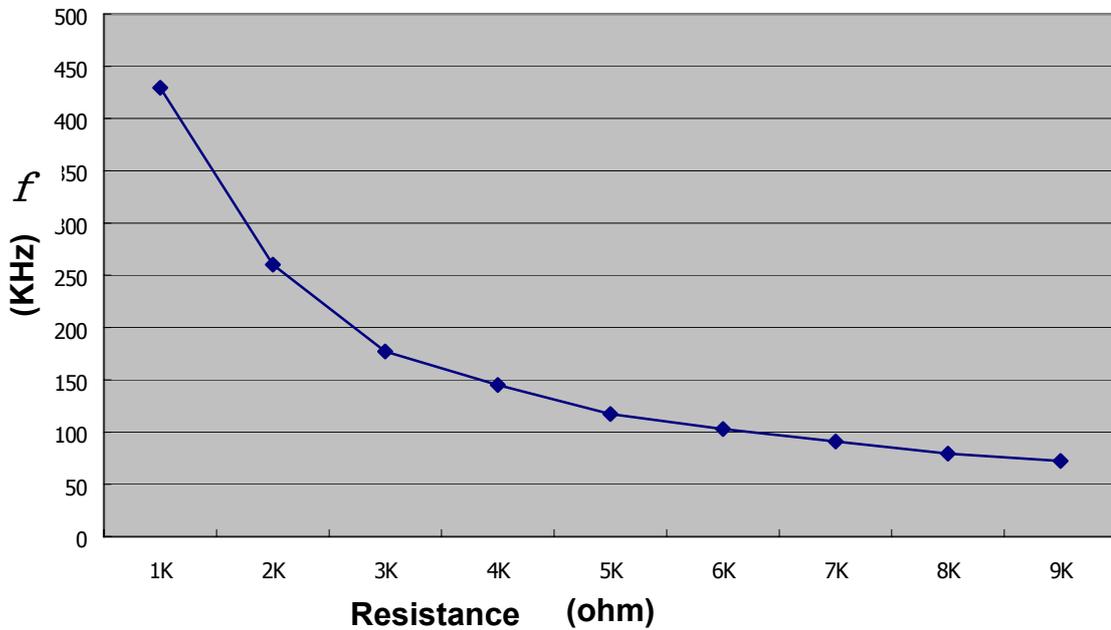


- When using the external RC oscillation in 1.5V operating application, the resistance and frequency relation chart (capacitance 1000pF) will be:

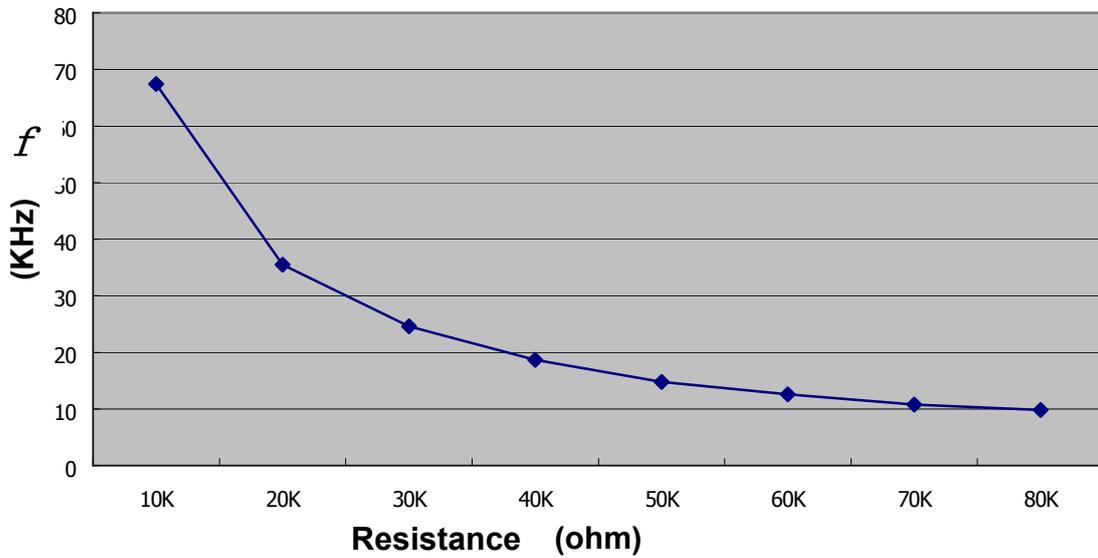
TM8726 1.5V slow RC R vs F (C=1000pF)



TM8726 1.5V slow RC R vs F (C=1000pF)

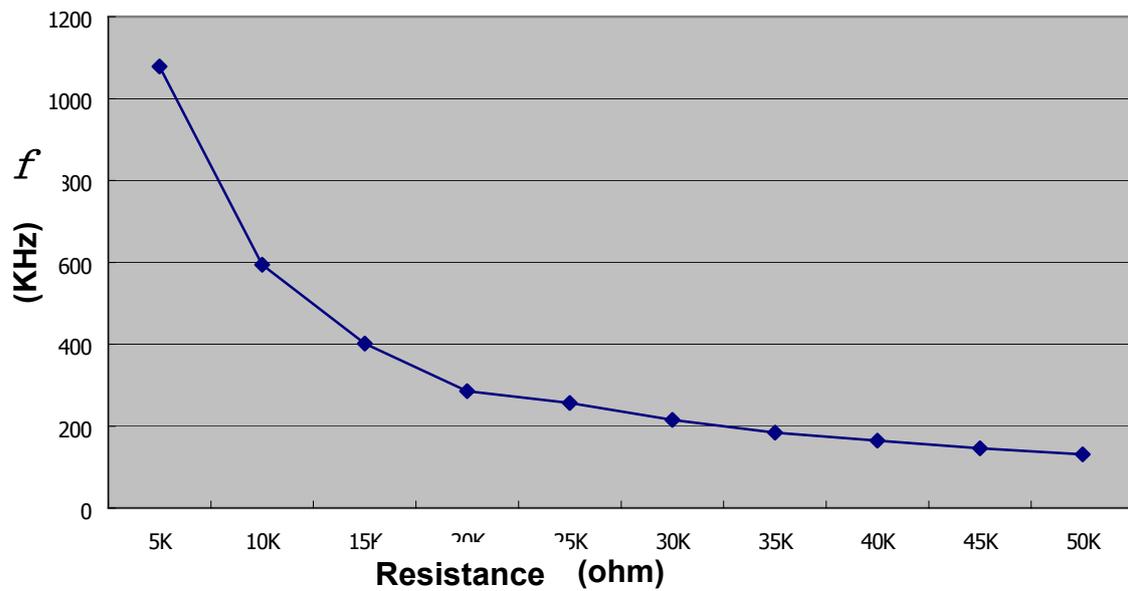


TM8726 1.5V slow RC R vs F (C=1000pF)

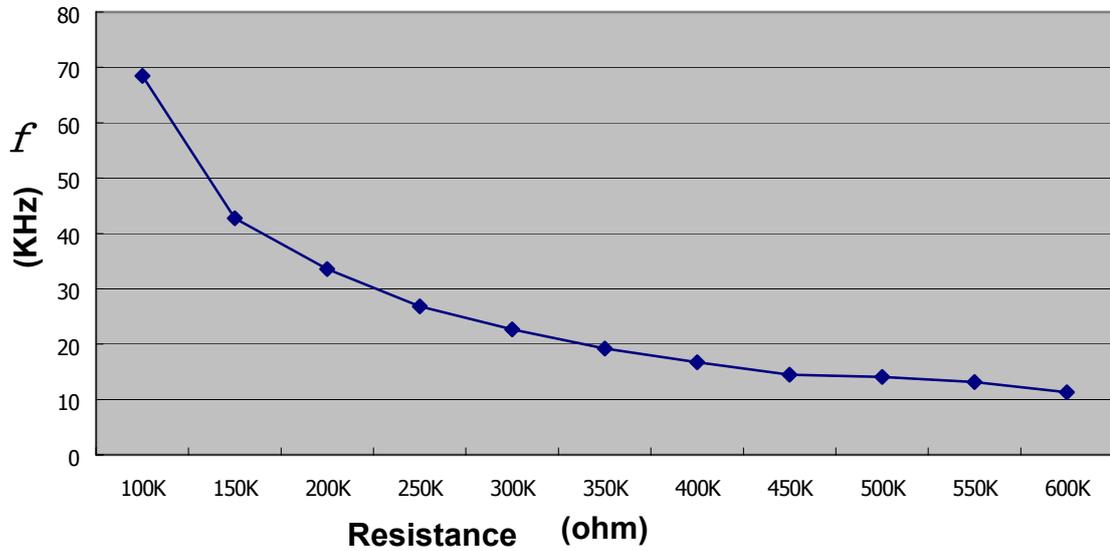


- When using the external RC oscillation in 3V operating application, the resistance and frequency relation chart (capacitance 100pF) will be:

TM8726 3.0V slow RC R vs F (C=100pF)

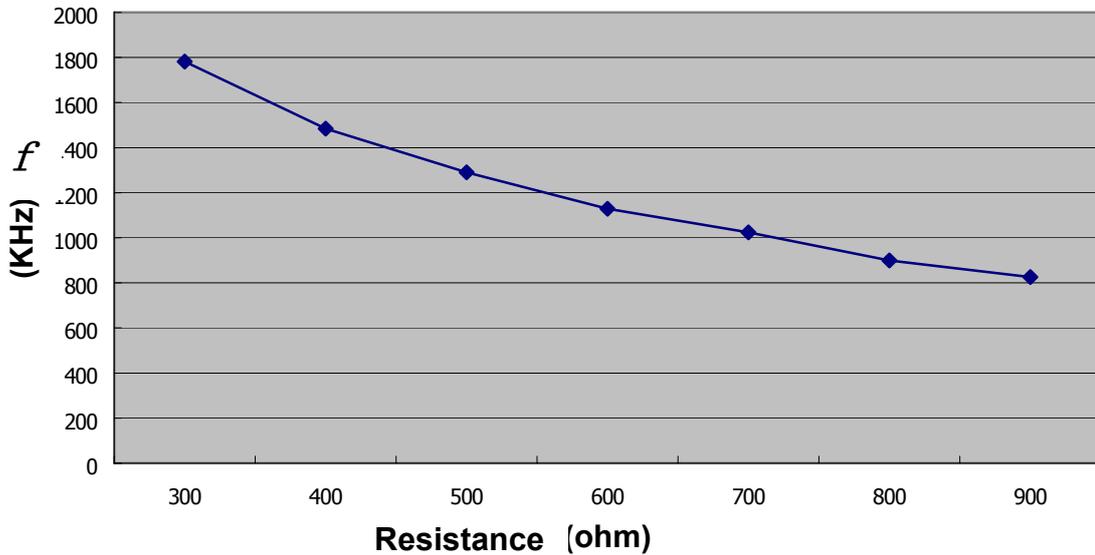


TM8726 3.0V slow RC R vs F (C=100pF)

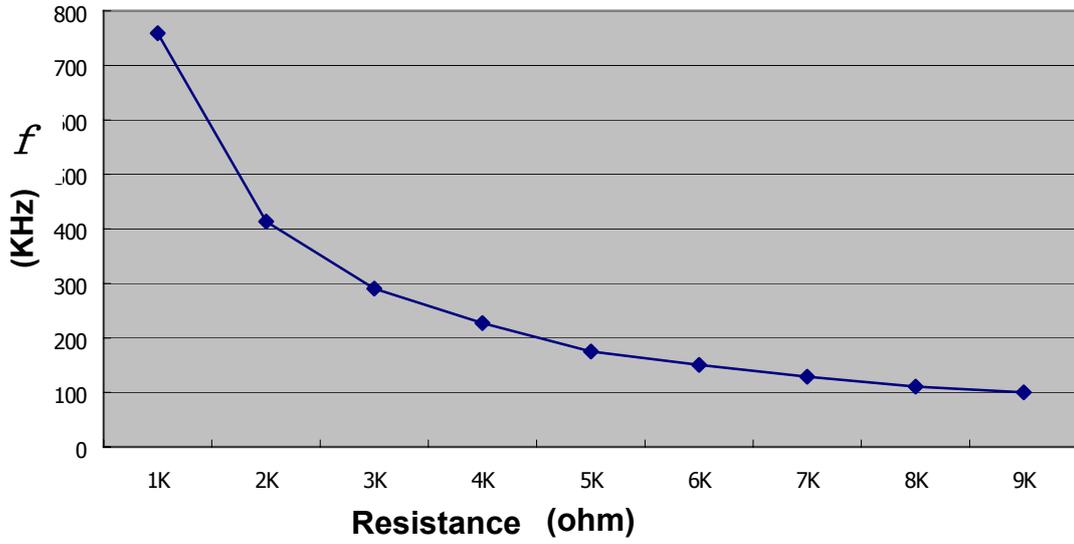


- When using the external RC oscillation in 3V operating application, the resistance and frequency relation chart (capacitance 1000pF) will be:

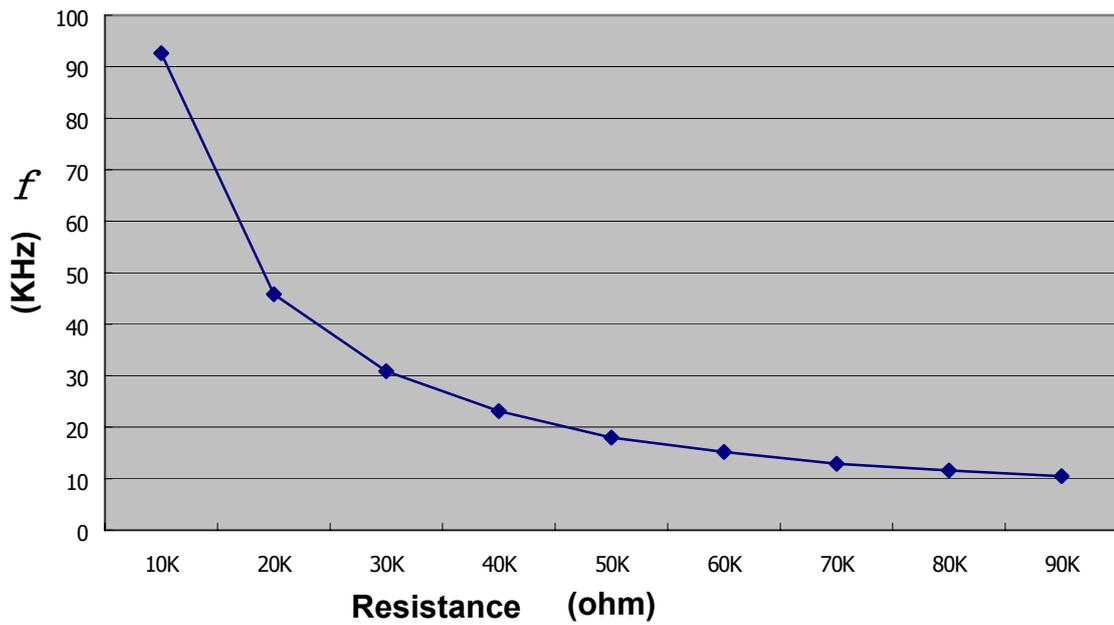
TM8726 3.0V slow RC R vs F (C=1000pF)



TM8726 3.0V slow RC R vs F (C=1000pF)



TM8726 3.0V slow RC R vs F (C=1000pF)



### III. Dual Clock mode

The TM87 series MCU can have the fast clock and the slow clock functions simultaneously through the use of mask option. The user can use the (Fast, slow) instructions to switch between the clock sources of the system clock generator so that the system can function under both the fast clock mode and the slow clock mode.

When the HALT instruction is executed, the system clock (BCLK) will switch to the slow clock automatically and use the clock signals generated by the slow clock oscillator as the basic frequency for the circuitries such as LCD driver module etc.

The graphs and tables provided in this AP-note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified operating frequency range) and therefore outside the warranted range.