REASONS OF THE TEMPERATURE PROBLEM IN NANOCOM FIRST SERIES (WITH COM PORT) AND ITS SOLUTION

PROBLEM CAUSES:

The temperature problem on the first series of Nanocoms is not caused by the heating of the components that, as you can see, never show high temperatures even after several working hours, but by the processor speed that is too high for the memory to which it was matched.

While projecting, at the moment of the evaluation between processor and memory, we have relied upon the documentation provided by the processor manufacturer, thus respecting the specifics required by this table.

TABLE 5-1: SELECTED MEMORY TIMING REQUIREMENTS AT VARIOUS OSCILLATOR FREQUENCIES

Oscillator Frequency	t_{ACC}* (16-bit mode)	t_{ACC}* (8-bit mode)	t_{OE}	t_{DF}	TadV2alL Address Setup Time
4 MHz	<715 ns	<360 ns	<475 ns	<120 ns	<240 ns
10 MHz	<265 ns	<130 ns	<175 ns	<45 ns	<90 ns
16 MHz	<150 ns	<75 ns	<100 ns	<25 ns	<50 ns
20 MHz	<115 ns	<60 ns	<75 ns	<20 ns	<40 ns
25 MHz	<85 ns	<40 ns	<55 ns	<15 ns	<30 ns

* Propagation delay t_{PROP} is assumed to be 10 ns.

So, a 16MHz oscillator was chosen to create the processor clock, to be matched with and a AM29F260D-70 memory with 8bit interfacing, mounted on the first 500 units with even better performances than expected, then followed by the AM29F260D-75 for the successive units and with performances equal to the ones requested. The documentation relative to AM29F260-70 guarantees an access time of 70 ns.

DATA SHEET

AMD

Am29F160D

16 Megabit (2 M x 8-Bit/1 M x 16-Bit) CMOS 5.0 Volt-only, Boot Sector Flash Memory

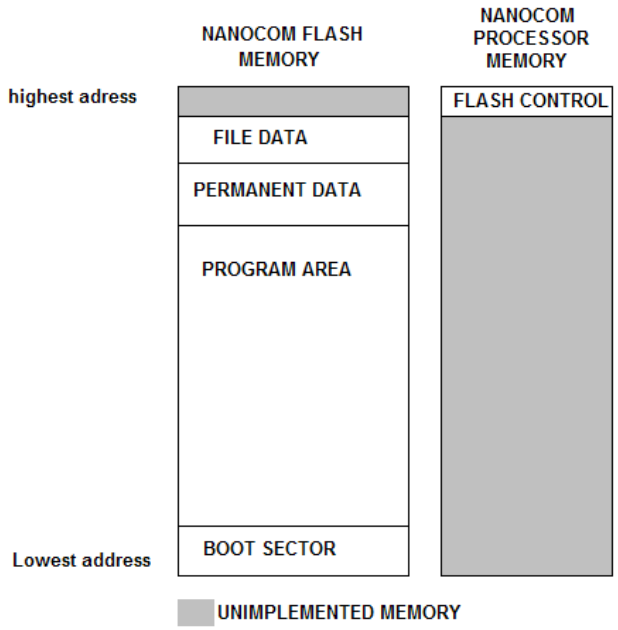
The Am29F160D is not offered for new designs. Please contact your Spansion representative for alternates.

DISTINCTIVE CHARACTERISTICS

- **5.0 Volt single power supply operation**
  - — Minimizes system-level power requirements
- **High performance**
  - — Access times as fast as 70 ns
- **Compatible with JEDEC standards**
  - — Pinout and software compatible with single-power supply Flash
  - — Superior inadvertent write protection

As long as the program was of limited dimensions everything went well, but with the increasing of the executable code, now of 228Kbyte compared to first series 50Kbyte, we realized that the either the memory or the processor doesn't keep the same performance in all addressing range. As a prove of this, you can see that when the temperature blocks the Nanocom (if it is not particularly high) the Boot allowing to load the firmware and placed in the memory area with the lower address still works.

This picture shows how the Nanocom memory is organized



These are the memory areas contained in the 29F160D-70 flash:

BOOT SECTOR is the part of program protected by accidental overwriting which allows to load the main executable program
PROGRAM AREA is the memory area where the executable program is placed
PERMANENT DATA is the area where the permanent data useful to the main program are stored
FILE DATA is the memory area where Nanocom stores the general data during the diagnostic session
These are the memories in the processor:
FLASH CONTROL is the area with the code that is necessary to manage the physical deleting and programming of the flash memory
Normally this problem does not cause any consequences, that is when temperature decrease to below critical values (on the latest software version 45° - 50° C) everything works properly again.
But in some cases, because of a strong overheating due to sunlight exposition, it happened that the unit lost its program , thus making Nanocom unusable.
This inconvenience happens because when temperature is very high, memory stops providing the data that are necessary to the processor for a correct working of the program, which thus continues to increase the address executing null operations. If the increasing continues up to the FLASH CONTROL area, which instead is placed inside the processor and so hasn't got any interfacing problems, this area might execute writing or deleting operations without any control up to, in the worst of cases, the deleting of the BOOT SECTOR.

We thus invite everyone who wants to use 2.00 or higher firmware to make the hardware upgrade as soon as this will be available.

SOLUTION

To finally solve the problem described above, we have decided to decrease the processor speed from 16MHz to 10MHz in order to guarantee that the processor memory interfacing is very far from the maximum rating . As you can see from the table, at 10MHz the memory has to guarantee access times inferior to 13ns, that is almost twice the value compared to the used memory.

The second series Nanocom adopting this modification when manufactured have passed a hard temperature test. The units with this modification have endured with no consequences and still go on working with no interruption at a temperature of 85° C for 20 minutes.

WHAT THE HARDWARE KIT CONSISTS OF AND HOW YOU CAN MAKE THE MODIFICATION

To make the modification you need to substitute the 16Mhz with the one of 10MHz and reprogramming the BOOT SECTOR with the new BOOT program. Unfortunately the BOOT SECTOR is not programmable via COM port, but you need an interfacing ciruit. To help those who want to modify their Nanocom without sending it back to us, and so without any expedition costs and risks, we have thought to provide a low –cost kit composed of:

- 10MHz quartz resonator (a very easy intervention that can be done by anyone who has a certain familiarity with a welder, or anyway feasible by any technician who repairs electric or domestic electronic devices)
- Small interface to program the BOOT SECTOR which execute the operation ina an easy and automatic way

As soon as the kit is available, a detailed document will be online with pictures showing how to execute the operation safely and easily.