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EC450 Homework2

Testing and Adjusting the DCO frequency on MSP430

There are 2 important global variables that are used to measure the internal clock frequency. Count is long integer array, each element in the array increment once when the internal clock ticks for 8 times (as default).

An integer index which increment when there is WDT interrupt.

WDT interrupt is controlled by the crystal, which gives the most accurate time. WDT interrupt is generated each second and the index is incremented at the same time.

In the code when index reach its maximum value we set it back to zero. This is also the point where I placed a breakpoint, so that in the debugging phase, I can stop the code at the proper time and read all the elements in the count array. It is because count array element is incremented only when DCO clock ticks 8 times, the final value in the array element count[n]\*8 + 40(There are 5 other instructions that occur when the crystal clock starts to tick, which takes DCO clock 40 cycles to finish)

Here are the data that I read from the debugging window and analyzed.

Standard error is very small so the result is very accurate and reliable.

|  |  |  |  |
| --- | --- | --- | --- |
| Default Setting | | | |
| Expression | value | |  |
| count[0] | 141566 | |  |
| count[1] | 141542 | |  |
| count[2] | 141517 | | Standard Deviation (value) |
| count[3] | 141545 | | 3.718 |
| count[4] | 141523 | |  |
| count[5] | 141541 | | Standard error |
| count[6] | 141511 | | 2.63E-05 |
| count[7] | 141503 | |  |
| count[8] | 141511 | |  |
| count[9] | 141513 | |  |
| count[10] | 141532 | |  |
| count[11] | 141539 | |  |
| count[12] | 141533 | |  |
| count[13] | 141550 | |  |
| count[14] | 141539 | | frequency(MHz) |
| Avg | 141531 | | 1.132288 |
| By reading the DCO frequency table, I noticed that if I want to have the DCO frequency to be closest to 10MHz, I would like to set RSELx = 14, DCOx = 3, MODx = 0 by setting DCOCTL = 0x60 and BCSCTL1 = 0x8E  Through test the frequency is around 11MHz, which is very close to 10 MHz. | | | |
| Adjusted (RSELx=14, DCOx=3, MODx=0) | | | |
| count[0] | | 1442694 |  |
| count[1] | | 1442751 |  |
| count[2] | | 1442847 | Standard Deviation (value) |
| count[3] | | 1442972 | 20.87 |
| count[4] | | 1442710 |  |
| count[5] | | 1442758 | Standard Error |
| count[6] | | 1442926 | 1.45E-05 |
| count[7] | | 1442959 |  |
| count[8] | | 1442934 |  |
| count[9] | | 1442954 |  |
| count[10] | | 1442864 |  |
| count[11] | | 1442831 |  |
| count[12] | | 1442850 |  |
| count[13] | | 1442755 |  |
| count[14] | | 1442949 | Frequency(MHz) |
| Avg | | 1442850.267 | 11.54284213 |