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| **EXP NO: 10** | **STUDY OF ARM KEIL µVISION IDE** | **DATE:** |

**AIM**:

To study the features and architecture of ARM(LPC2148) microcontroller and also about KEIL µvision IDE for ARM.

**LPC2148** **MICROCONTROLLER**:

The LPC2148 microcontroller is designed by Philips with several inbuilt features and peripherals. Due to three reasons, it will make more reliable as well as the efficient option for an application developer. LPC2148 is a 16 bit or 32 bit microcontroller based on ARM 7 family.

**FEATURES OF LPC2148:**

The main features of LPC2148 includes the following:

* The LPC2148 is the 16 bit or 32 bit ARM7 family based microcontroller and available in a small LQFP64 package.
* On-chip static RAM is 8kb-40kb, on-chip flash memory is 32kb-512kb, the wide interface is 128 bit, or accelerator allows 60mhz high-speed operation.
* It takes 400 ms time for erasing the data in full chip and 1 ms time for 256 bytes of programming.
* It has 2kb of endpoint RAM and USB 2.0 full speed device controller. Furthermore, this microcontroller offers 8kb on-chip RAM nearby to USB with DMA.
* One or two 10 bit ADC’s offer 6 to 14 analog inputs with low conversion time as 2.44 us/channel.
* Only 10 bit DAC offers changeable analog output.
* Lower power RTC and 32 khz clock input.
* Several serial interfaces like two 16C550 UARTs, two 12C buses with 400 kbps speed.
* 5 volts tolerant quick general purpose input/output pins in a small LQFP64 package.
* 60mhz of utmost CPU clock obtainable from the programmable-on-chip phase locked loop by resolving time is 100us.
* The incorporated oscillator on the chip will work by an exterior crystal that ranges from 1mhz-25mhz.
* The modes for power conserving mainly comprise idle and power down.

**GENERAL ARCHITECTURE AND BLOCK DIAGRAM OF LPC2148 MICROCONTROLLER:**

LPC2148 microcontroller consists of three buses such as ARM7 local bus, AHB and VPB bus etc. These buses are used for performing different function and these are also consisting of different functioning ports such as

GPIO PINS:

ARM based LPC2148 microcontroller has 45 general purpose input output pins. The operating voltage of these input output pin is 5V.

ON-CHIP STATIC RAM:

This on chip static RAM is used for storing data or code. This RAM could be accessed as 6bit, 16bit, or 32 bit. The memory of this RAM could be increased to 8kb, 16kb, or 32kb by using USB.

ON-CHIP FLASH PORGRAM MEMORY- LPC2148:

LPC2148 microcontroller contains 512 kb on chip flash memory this memory is used for almost data storage or code storage. The programming of this flash memory could be accomplished with several ways.

VECTORED INTERRUPT CONTROLLER:

All interrupt requests are received by vectored interrupt controller and it converts them into fast requests(FIQ). So, fast interrupt request and non fast are defined by programming setting in vectored interrupt controller.

DIGITAL TO ANALOG CONVERTER:

The LPC2148 microcontroller has one 10 bit DAC which converts digital input to analog inputs. The maximum DAC output voltages are called VREF voltages. Power down mode and buffered output is also available in this digital to analog converter.

ANALOG TO DIGITAL CONVERTER:

The microcontroller has two UART whose names are UART 0 and UART 01. These UARTs are provided the full mode control handshake interface during transmitting or receiving the data lines. They are used 16 byte data rate during transmitting / receiving the data. For covering wide range of baud rate upto 400k. similarly the serial clock synchronization allows the device to communicate the data of different baud rate pass through only oe serial bus. This clock synchronization could be used as handshake mechanism for resuming or suspending the data transfer.

SPI SERIAL I/O CONTROL:

This SPI serial I/O control supports the duplex data transfer, means this control supports the device for transferring the data whose range 4kb to 16kb from master bus to slave bus. This operation is called synchronous serial communication operation from master bus to slave bus. This data is transmitted or received in 8 frames and each frame contains 4 bits to 16 bits.

TIMERS:

This LPC2148 microcontroller has two timers or counters. These timers are 32 bits and are programmable with 32 bit pre scaler value as well as it also has one external event counter. Each time has four 32 bit capture channels which take the snapshot of timer value during the transition of any input signal. With the help of this capture event the interruption could be also generated.

WATCHDOG TIMER:

This LPC2148 microcontroller also contains the watchdog timer whose main purposes is to rest the microcontroller with is specific amount of time during erroneous state. After this state it turned on the microcenter with in specific amount of time limit.

CRYSTAL OSICLLATOR:

This LPC2148 microcontroller contains the on chip integrated oscillator which operate with an external crystal whose range is in between 1 mhz to 25 mhz. Its output frequency is called focs and controller clock frequency is called CCLK. These names are used for making rate equation. These frequencies would be same when then PLL is connected and in running position .

OSCILLATOR MODES AND MODELS:

* Slave mode of operation
* Oscillation mode of operation
* External crystal model used for cx1/cx2 evaluation.

PHASE LOCKED LOOP: (PLL)

This LPC2148 microcontroller contains two phase locked looper whose names are PLL0 and PLL1. The input frequency whose range is in between 1 mhz to 25 mhz is accepted by this PLL> this frequency range could be extended from 10 mhz to 60 mhz by using the current controlled oscillator.

LPC2148 microcontroller REGISTERS:

This LPC2148 microcontroller also consists of one program status register of 16 general purpose registers whose names are R0 to R15. These registers has wide ranges such as 8,16 and 32 bits. Beside this, it also consists of one shadow register which is selected such as operation mode switch.

INTERRUPTS:

It has vectored interrupt controller. It can be configured with 16 configuration priorities. LPC2148 microcontroller has 9 level or edge triggered external interrupts.

POWER SAVING MODES:

It has power saving modes also like the idle mode and sleep mode.

**KEIL UVISION 5 IDE FOR ARM:**

KEIL µvision is a sophisticated IDE and debugger/simulator that offers numerous benefits to serious ARM embedded developers.

**FEATURES:**

The µvision device database automatically configures the development tools for the target microcontroller.

The µvision IDE integrates additional third party tools like VCS, CASE and FASH/ device programming. µvision incorporates project manager, editor and debugger in a single environment Identical Target Debugger and Simulator User Interface. The code coverage feature of the µvision simulator provides statistical analysis of your program’s execution. The µvision simulator is the only debugger that completely simulates all on-chip peripherals of the ATMEL, PHILIPS and SAMSUNG smart card devices. Simulation capabilities may be expanded using the Advanced Simulation Interface(AGSI).

EXECUTING ASSEMBLY LANGUAGE PROGRAM IN KEIL MICROVISION SOFTWARE:

Following the steps to execute assembly language programs in keil µvision software:

* Open Keil µvision software then click on the project then click on the new µvision project.
* Save your file with .s extension for example addition.s and save it.
* Save ARM LPC2148 and then click Ok.
* Now click on target 1 and then double click on source group 1, select the file that you previously saved with extension .s and add it to the source group, and close it.
* Now click on the + sign shown before source group 1, then double click on the file that comes after clicking on + sign. Then write assembly language code in the plane text area that appears.
* Click on build and rebuild to check errors then click on debug and start debug session.
* Then click on run and then you can either directly run or you can run step by step by clicking every time on the step by pressing F11 and then check the output here the output is visible in blue colour.

By following the above mentioned steps, you can execute any types of assembly language statements or instructions and assembler directives in Keil µvision software.

**RESULT:**

Thus the features, architecture of ARM LPC2148 and features of KEIL µvision and VERSION 5 and steps on executing the assembly language program in KEIL µvision5 are explained.







