USER'S MANUAL
FOR

ARM LPC1768
DEVELOPEMET BOARD

Manufactured By

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INTRODUCTION & OVERVIEW OF ARM LPC1768 DVK

Logsun's ARM LPC1768-DVK is 32-bit LPC1768 is an ARM Cortex-M3 based Microcontroller evaluation module. ARM LPC1768-DVK is a general-purpose development board for ARM Controller. ARM LPC1768-DVK can be used extensively to test and validate programs. This provides advance features like ISP, I2C and IAP. The microcontroller has 512 kB on-chip flash programming memory and Up to 64 kB On-chip SRAM. The development board comes with RS-232 and USB interface to allow user to program microcontroller directly from PC. ARM LPC1768-DVK board and related software routines help the system designers to rapidly design and prototype their designs based on ARM Core. It provides a complete development platform with different modules interface that accelerates the task of designers to run application software on target ARM Controller hardware, thus providing a platform to benchmark their system, save time & expense of building their own application test board and enabling them to get their designs to market quickly. ARM LPC1768-DVK is a unique hardware and software combination, providing designers the tool to develop most advanced ARM series Microcontroller applications. The ARM LPC1768-DVK hardware reference and software application programs also simplify ARM based hardware and software development.

SPECIFICATION:

1. LPC1768 ARM Cortex-M3 microcontroller
2. On board Serial & USB Connector for Programming
3. Internal ADC interface
4. On board 16x2 LCD
5. On board I^2C EEPROM interface
7. On board DC Motor Driver
8. On board Stepper Motor Driver
9. On board Relay Buzzer & LED interface
10. On board SD-Card Slot
11. Internal RTC interface
12. On board 4x4 Matrix Keypad
13. Internal DAC interface

Getting Started:

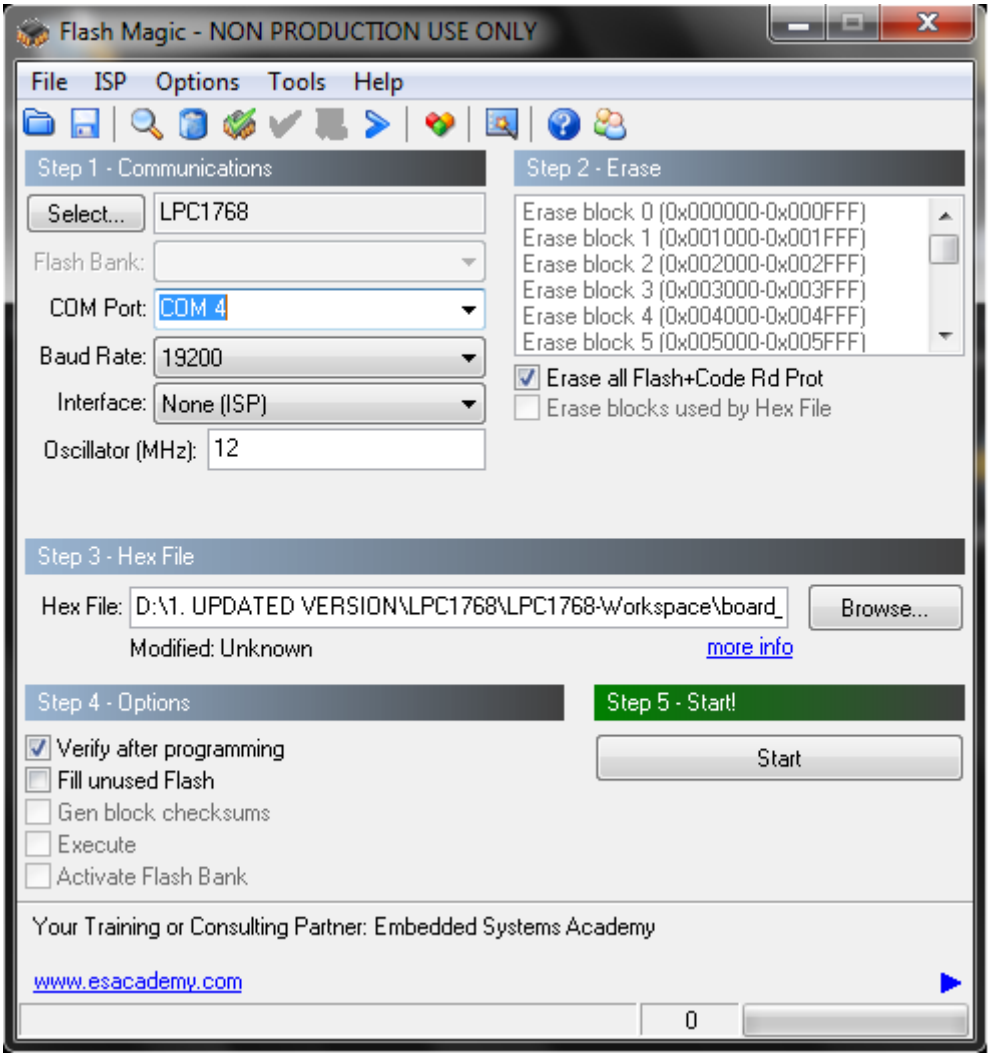
LGS –ARM LPC1768 Development Board Includes:
1. Male to Female Straight Cable (DB-9) or USB to Serial Converter or A-B USB Cable.
2. 12V Power Adapter.
4. User's Manual
5. Google drive link contains:
    a) Flash Utility for IC.
    b) Required Software (KeiluVision Evaluation Version) (16K Code Size).
    c) Sample Codes for development Board.
    c) Schematic.

HOW TO USE FLASH MAGIC?

LPC1768 is used as Main Microcontroller in ARM DVK. Flash magic software by NXP is used to upload the firmware to the target board. To install the Flash Magic software, run the setup provided.

Program Uploading Steps using flash Magic:

- Connect the Power adaptor to the board.
- Connect the supplied serial cable or USB to serial converter between the microcontroller board & computer.
- Open Flash Magic Software.



- In Step 1 – **Communications** select the following parameters:
  - **Select**: **LPC1768** (As per requirement)
  - **COM Port**: COM1/COM2 (As per USB cable connected to PC)
  - **Baud Rate**: 19200 (As per requirement)
  - **Interface:** None (ISP)
  - **Oscillator** (MHz): 12

- In Step 2 – **Erase** select the following parameters:
  - Click on Erase all Flash+Code Rd Prot

- In Step 3 – **Hex File** select the following parameters:
  - Using the Browse button load the appropriate ***.HEX** file provided in CD.(S3 switch must be in down position to select USB communication).

- In Step 5 – **Start!**

  Press RESET switch then program switch (hold both) then click on START on flash magic. Now release RESET then release PROGRAM switch.

- At the right bottom of Flash Magic window, you can see the progress of program downloading in graphical format and at left bottom you can see the process. Wait until it shows "**Finished**" to finish downloading process.

- Now press the **RESET** Key on board & you can see / observe the corresponding output.

NOTE: Before uploading any .hex file make sure that FRC's are removed and serial terminal window is closed.

EXPERIMENT NO. 1

AIM:- Interfacing of LED with LPC1768.

REQUIREMENT: - ARM LPC1768-DVK, 12V Power Adaptor, 10 pin FRC, USB Cable.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect USB cable between LPC1768 DVK & PC.
3) Open the Flash Magic software and make settings as mentioned above.
4) Upload the Hex file to LPC1768 Board.
5) Connect 10 pin FRC from **SV1** (P0.0-P0.7) to **J21** LED.
6) Press the Reset switch on DVK.
7) **LED will TURN ON in sequence with some delay from L11 to L4.**

PIN DESCRIPTION: -

SV1 (P0.0-P0.7)	**J21 LEDS**
5V	5V
GND	GND
P0.0	LD0
P0.1	LD1
P0.2	LD2
P0.3	LD3
P0.4	LD4
P0.5	LD5
P0.6	LD6
P0.7	LD7

EXPERIMENT NO. 2

AIM:- Interfacing of LED ,switches with LPC1768.

REQUIREMENT: - ARM LPC1768-DVK, 12V Power Adaptor, 10 pin FRC USB Cable.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect USB cable between LPC1768 DVK & PC.
3) Open the Flash Magic software and make settings as mentioned above.
4) Upload the Hex file to LPC1768 Board.
5) Connect 10 pin FRC from **SV1 (P0.0-P0.7)** to **J21 LED** & **SV3 (P1.0-P1.15)** to **J22 SWITCHES.**
6) press reset switch on DVK
7) **LED TURN ON AS PER SWITCH LOGIC.**

PIN DESCRIPTION: -

SV1 (P0.0-P0.7)	J21 LEDS
5V	5V
GND	GND
P0.0	LD0
P0.1	LD1
P0.2	LD2
P0.3	LD3
P0.4	LD4
P0.5	LD5
P0.6	LD6
P0.7	LD7

SV3 (P1.0-P1.15)	J22 SWITCH
5V	5V
GND	GND
P1.0	S1
P1.1	S2
P1.4	S3
P1.8	S4
P1.9	S5
P1.10	S6
P1.14	S7
P1.15	S8

EXPERIMENT NO.3

AIM: - Interfacing of 16 x2 LCD (4Bit) with LPC1768.

REQUIREMENT: -ARM LPC1768-DVK, 12V Power Adaptor, 10 pin FRC, USB Cable.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect the USB cable between LPC1768 DVK & PC.
3) Open the Flash Magic software and make settings as mentioned above.
4) Upload the Hex file to LPC1768 Board.
5) Connect 10 pin FRC from **sv1** (P0.0-P0.7) to **J9** (LCD Data) of LCD section**. Short 1, 2 pins of RS, RW, EN jumper.**
6) Press Reset Switch.
7) Output will be displayed on LCD as **" This is LPC 1768 Dev kit ARM CORTEX M-3"**

PIN DESCRIPTION: -

SV1 (P0.0-P0.7)	**J9 (LCD Data)**
5V	5V
GND	GND
P0.0	Data0
P0.1	Data1
P0.2	Data2
P0.3	Data3
P0.4	Data4
P0.5	Data5
P0.6	Data6
P0.7	Data7

EXPERIMENT NO.4

AIM: - Interfacing of 16 x2 LCD (4Bit) and keypad with LPC1768.

REQUIREMENT: -ARM LPC1768-DVK, 12V Power Adaptor, 10 pin FRC, USB Cable.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.

2) Connect the USB cable between LPC1768 DVK & PC.

3) Open the Flash Magic software and make settings as mentioned above.

4) Upload the Hex file to LPC1768 Board.

5) Connect 10 pin FRC from **sv1** (P0.0-P0.7) to **J9** (LCD Data) of LCD section**. Short 1, 2 pins of RS, RW, EN jumper.**

6) Press Reset Switch.

7) Output will be displayed on LCD as corresponding number we entered.

Note: you can see output on LCD as "Hello, World Good Morning" now press any key from keypad given on DVK, that corresponding key pressed will be shown on LCD as output.

PIN DESCRIPTION: -

SV1 (P0.0-P0.7)	**J9 (LCD Data)**
5V	5V
GND	GND
P0.0	Data0
P0.1	Data1
P0.2	Data2
P0.3	Data3
P0.4	Data4
P0.5	Data5
P0.6	Data6
P0.7	Data7

SV5 (P2.0-P2.7)	**J13 (Control signals)**
5V	5V
GND	GND
P2.0	R1
P2.1	R2
P2.2	R3
P2.3	R4
P02.4	C1
P2.5	C2
P2.6	C3
P2.7	C4

EXPERIMENT NO. 5

AIM: - Interfacing of Relay, Buzzer

REQUIREMENT: - ARM LPC1768-DVK, 12V Power Adaptor, 10 pin FRC, USB Cable.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect the serial or USB cable between LPC1768 DVK & PC.
3) Open the Flash Magic software and make settings as mentioned above.
4) Upload the Hex file to LPC1768 Board.
5) Connect 10 pin FRC from **SV1** (P0.0-P0.7) to **J7** (Relay Buzzer Section).
6) Press Reset Switch.
7) **Press Switches in Relay Buzzer Section to change the Output Pattern.**

PIN DESCRIPTION: -

SV1 (P0.0-P0.7)	**J7 (Relay Buzzer)**
5V	5V
GND	GND
P0.0	T5
P0.1	T6
P0.2	INT0/S20
P0.3	INT1/S21
P0.4	LD0
P0.5	LD1
P0.6	LD2
P0.7	LD3

EXPERIMENT NO. 6

AIM: - Interfacing of DC Motor with LPC1768.

REQUIREMENT: - ARM LPC1768-DVK, 12V Power Adaptor, 10 pin FRC, USB Cable.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect USB cable between LPC1768 DVK & PC.
3) Open Flash Magic software and make settings as mentioned above.
4) Upload the Hex file to LPC1768 Board.
5) Connect 10 pin FRC from SV5 (P2.0-P2.7) to J14 (EN-IN) & SV2 (P0.8-P0.18) to J15 (Start Stop) of DC Motor section.
6) Make both Jumper Setting as 1&2 Short of jp6, jp7 also short MOTOR AND +5V & Connect DC Motor at RL3.
7) Press reset switch on DVK
8) You can observe the output by pressing the respective switches in DC motor section to change Speed & Direction of DC Motor.

PIN DESCRIPTION: -

NOTE: - *JUMPER JP6 & JP7 → 1&2 SHORT*

SV5 (P0.0-P0.7)	**J14 (DC Motor EN-IN)**
5V	5V
GND	GND
P2.0	EN1
P2.1	EN2
P2.2	NC
P2.3	NC
P2.4	I/P1
P2.5	I/P2
P2.6	I/P3
P2.7	I/P4

SV2 (P0.8-P0.15)	**J15 (DC Motor Start Stop)**
5V	5V
GND	GND
P0.8	START
P0.9	REV
P0.10	INC
P0.11	DCR
P0.15	STOP
P0.16	NC
P0.17	NC
P0.18	NC

EXPERIMENT NO. 7

AIM: - Interfacing of Stepper Motor with LPC1768.

REQUIREMENT: - ARM LPC1768-DVK, 12V Power Adaptor, 10 pin FRC, USB Cable.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect the serial or USB cable between LPC1768 DVK & PC.
3) Open the Flash Magic software and make settings as mentioned For more setting regarding Ethernet, refer sample code..
4) Upload the Hex file to LPC1768 Board.
5) Connect 10 pin FRC from **SV1** (P0.0-P0.7) to **J14** (EN-IN) & **SV2** (P0.8-P0.18) to **J15** (Start Stop) of Motor section.
6) Make both Jumper Setting as 2&3 Short of jp6, jp7 also short MOTOR AND +5V & Connect DC Motor at RL3.
7) Press reset switch on DVK.
8) You can observe the output by pressing the respective switches in stepper motor section to change Speed & Direction of STEPPER Motor.

PIN DESCRIPTION: -

NOTE: - *JUMPER JP6 & JP7 → 2&3 SHORT*

SV1 (P0.0-P0.7)	**J14 (Stepper Motor EN-IN)**
5V	5V
GND	GND
P0.0	EN1
P0.1	EN2
P0.2	NC
P0.3	NC
P0.4	I/P1
P0.5	I/P2
P0.6	I/P3
P0.7	I/P4

SV2 (P0.8-P0.15)	**J15 (Stepper Motor Start Stop)**
5V	5V
GND	GND
P0.8	START
P0.9	REV
P0.10	INC
P0.11	DCR
P0.15	STOP
P0.16	NC
P0.17	NC
P0.18	NC

EXPERIMENT NO. 8

AIM: - Serial (UART) Rx - TX with LPC1768.
REQUIREMENT: -ARM LPC1768-DVK, 12V Power Adaptor, USB Cable.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect USB cable between LPC1768 DVK & PC.
3) Keep **S3** switch down for downloading and checking the output of USB.
4) Open the Flash Magic software and make settings as mentioned above.
5) Upload the UART_Tx string Hex file to LPC1768 Board.
6) Then close FLASH MAGIC SOFTWARE window.
7) Observe the output on any Serial terminal Software such as **Hercules/HyperTerminal** /Putty. (Set the COM port and choose the baud Rate to 9600).
8) Press the reset switch on DVK.
9) Observe String "**Welcome to 1768** " Send on Serial Port

EXPERIMENT NO. 9

AIM: - Generation of PWM (Pulse Width Modulation) using LPC1768.
REQUIREMENT: -ARM LPC1768-DVK, 12V Power Adaptor, USB Cable.

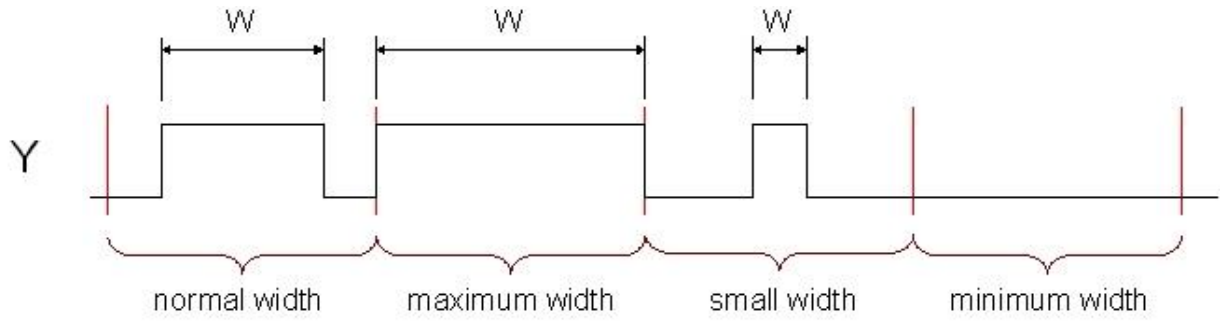
THEORY:

Pulse-width modulation (PWM) is a powerful technique for controlling analog circuits with a microcontroller's digital outputs. PWM is used in many applications, ranging from communications to power control and conversion. For example, the PWM is commonly used to control the speed of electric motors, the brightness of lights, in ultrasonic cleaning applications, and many more.

A PWM is basically a digital unipolar square wave signal where the duration of the ON time can be adjusted (or modulated) as desired. This way the power delivered to the load can be controlled from a microcontroller.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect USB cable between LPC1768 DVK & PC.
3) Open the Flash Magic software and make settings as mentioned above.
4) Upload the PWM code Hex file to LPC1768 Board.
5) Then close FLASH MAGIC SOFTWARE window.
6) We can observe the output on P2.0 pin of port 2.
7) Connect P2.0 to positive probe of CRO and GND to respective ground pin.
8) Press reset switch on DVK.
9) Observe the output on CRO as **PWM signal**.



EXPERIMENT NO. 10

AIM: - Interfacing of CAN with LPC1768.
REQUIREMENT: -ARM LPC1768-DVK, 12V Power Adaptor, USB Cable.

THEORY:
The CAN protocol is a standard designed to allow the microcontroller and other devices to communicate with each other.

It is a serial half-duplex and asynchronous type of communication protocol. The CAN is a two-wired communication protocol as the CAN network is connected through the two-wired bus. CAN bus consist of two lines, i.e., CAN low line and CAN high line, which are also known as CANH and CANL, respectively. The transmission occurs due to the differential voltage applied to these lines.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect USB cable between LPC1768 DVK & PC.
3) Open the Flash Magic software and make settings as mentioned below.

CAN1	CAN2
HI	HI
LOW/LO	LOW/LO
GND	GND

4) Upload the CAN communication, code Hex file to LPC1768 Board.
5) Then close FLASH MAGIC SOFTWARE window.
6) Open the Hercules software, select proper COM PORT AND SET Baud rate to **115200.**
7) Press the reset switch on DVK.
8) You can observe the output on Serial Window.

EXPERIMENT NO. 11

AIM: - Interfacing of ADC using LPC1768.
REQUIREMENT: -ARM LPC1768-DVK, 12V Power Adaptor, USB Cable.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect USB cable between LPC1768 DVK & PC.
3) Open the Flash Magic software and make settings as mentioned below.
4) Upload the ADC code Hex file to LPC1768 Board.
5) Then close FLASH MAGIC SOFTWARE window.
6) Connect ADC/analog input to **ADC+DAC section** of DVK.

ADC+DA section	Sensor/module
3.3V	VCC
GND	GND
AD01	Analog input

7) Open the Hercules software, select proper COM PORT and set Baud rate to **115200.**
8) Press the reset switch on DVK.
9) You can observe the output on serial window, as you change in analog value corresponding digital value on Serial Window will display.

Note:

For ADC input, you can use the POT output from universal Embedded Card. To use Universal Embedded card for Analog Input, connect the VCC and ground from 1768 DVK board to the J16 connector on the Universal Embeded Interfacing card, and connect any one of the X1/X2/X5 connector to the AD01 pin of the 1768 DVK.

EXPERIMENT NO. 12

AIM: - Interfacing of Ethernet with LPC 1768 DVK.
REQUIREMENT: -ARM LPC1768-DVK, 12V Power Adaptor, USB Cable, Ethernet expansion board, ETH DP83848 module, 10-Pin FRC x 2, Ethernet cable.

PROCEDURE:-

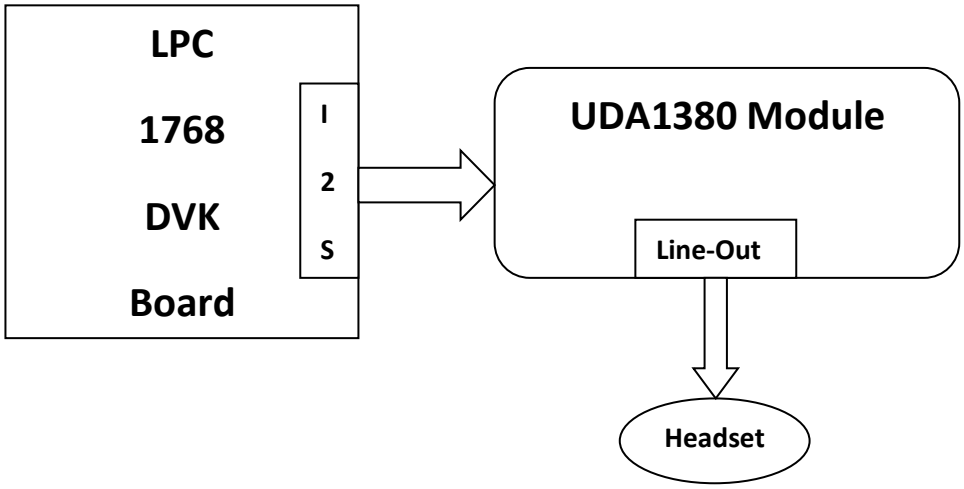
1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect USB cable between LPC1768 DVK & PC.
3) Connect SV-3 to ETH1
4) Connect SV-4 to ETH-2
5) Connect Ethernet Cable to DP83848 Ethernet Module.
6) Connect another End of Ethernet cable to PC.
7) Change the PC IP to 192.168.0.XXX
8) Open the Flash Magic software and make settings as mentioned.
9) Upload the Ethernet code Hex file to LPC1768 Board.
10) Press RESET switch.
11) Open the browser on PC, and enter the IP 192.168.0.100 to observe the output.
12) For more setting regarding Ethernet, refer sample code.

EXPERIMENT NO. 13

AIM: - Interfacing of I2S with LPC 1768 DVK.
REQUIREMENT: -ARM LPC1768-DVK, 12V Power Adaptor, USB Cable, UDA1380 Sound out module*.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect USB cable between LPC1768 DVK & PC.
3) Connect the UDA1380 module to I2S interface on 1768 DVK board.
4) Connect Earphone to LINEOUT socket of the UDA1380 module.
5) Open the Flash Magic software and make settings as mentioned.
6) Upload the I2S sample code Hex file to LPC1768 Board.
7) Press RESET switch.
8) Hear the output on headphones.
9) For more setting regarding I2S, refer sample code.



EXPERIMENT NO. 14

AIM: - Interfacing of SD card with LPC 1768 DVK.
REQUIREMENT: -ARM LPC1768-DVK, 12V Power Adaptor, USB Cable, SD card Module*.

PROCEDURE:-

1) Connect the 12V Power Adaptor to LPC1768 DVK.
2) Connect USB cable between LPC1768 DVK & PC.
3) Insert the SD card of 8GB or less into SD card Interface.
4) Open the Flash Magic software and make settings as mentioned.
5) Upload the DS card sample code Hex file to LPC1768 Board.
6) Press RESET switch.
7) Observe the output on Serial Monitor.

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FRC CONNECTION DETAILS

Sr. no.	Experiment	LPC1768 DVK	Interfacing Port
1	16x2 LCD (4 Bit)	SV1 (P0.0-P0.7)	J9 (LCD Data)
2	16x2 LCD (4 Bit) with keypad	Sv1 Sv5	J9 J13
3	Relay, Buzzer & LEDs	SV1 (P0.0-P0.7)	J7(Relay Buzzer)
4	DC Motor (Short 1&2 of Jumper JP6 & JP7)	SV5 SV2	J14 (DC Motor EN-IN) J15 (DC Motor Start Stop)
5	Stepper Motor (Short 2&3 of Jumper JP6 & JP7)	SV1 SV2	J14 (Stepper Motor EN-IN) J15 (Stepper Motor Start Stop)
6	Serial Rx – Tx/UART	CONNECT USB A-B CABLE PC TO DVK	OPEN HERCULES SOFTWARE Baud rate=9600
7	LED WITH SWITCHES	SV1 Sv3	J21 J22
8	LED	SV1	J21
9	Interfacing of Ethernet	Connect Ethernet Cable at X3 port on DVK	Open Hercules software
10	Interfacing of CAN	Connections between CAN1 and CAN2 HI =>HI LO=>LO GND=>GND	Open Hercules and set baud rate =115200
11	Generation of PWM	P2.0	Check output on CRO
12	Interfacing of ADC	ADC+DAC section with module/sensor 3.3V to VCC,GND to GND,AD01 to AD0	Check output on Hercules,set baud rate=115200
13	Interfacing of SD card		Observe the output on serial monitor
14	Interfacing of I2S		Hear the output on headphones