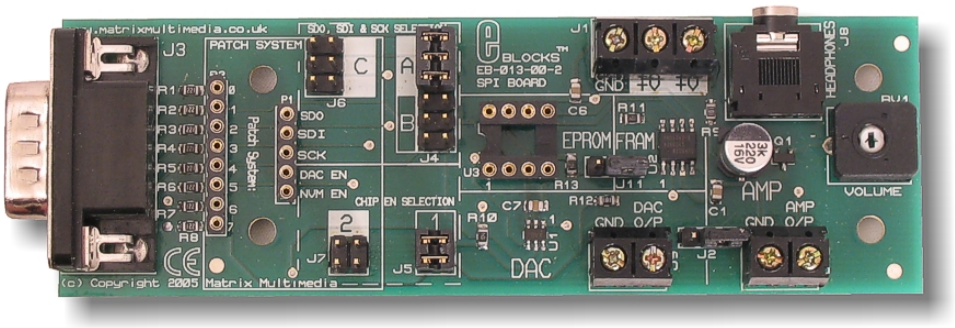
SPI Memory and D/A board datasheet EB013-00-2



Contents

1. About this document

This document concerns the E-blocks SPI Memory and D/A board code EB013 version 1.

The order code for this product is EB013.

1. Trademarks and copyright

PIC and PICmicro are registered trademarks of Arizona Microchip Inc.
E-blocks is a trademark of Matrix Multimedia Limited.

2. Other sources of information

There are various other documents and sources that you may find useful:

Getting started with E-Blocks.pdf

This describes the E-blocks system and how it can be used to develop complete systems for learning electronics and for PICmicro programming.

PPP Help file

This describes the PPP software and its functionality. PPP software is used for transferring hex code to a PICmicro microcontroller.

C and assembly strategies

This is available as a free download from our web site.

3. Disclaimer

The information in this document is correct at the time of going to press. Matrix Multimedia reserves the right to change specifications from time to time. This product is for development purposes only and should not be used for any life-critical application.

4. Technical support

If you have any problems operating this product then please refer to the troubleshooting section of this document first. You will find the latest software updates, FAQs and other information on our web site: www.matrixmultimedia.com . If you still have problems please email us at: support@matrixmultimedia.co.uk.

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2. General information

1. Description

This E-block allows investigation of chip-to-chip serial communication protocols, specifically aimed at the SPI interface. The board also provides Non Volatile Memory and a Digital to Analogue Converter. An on board amplifier provides a low current output from the D / A. Also on board is a headphone socket for use in audio applications. Flowcode macros for driving this E-block are available.

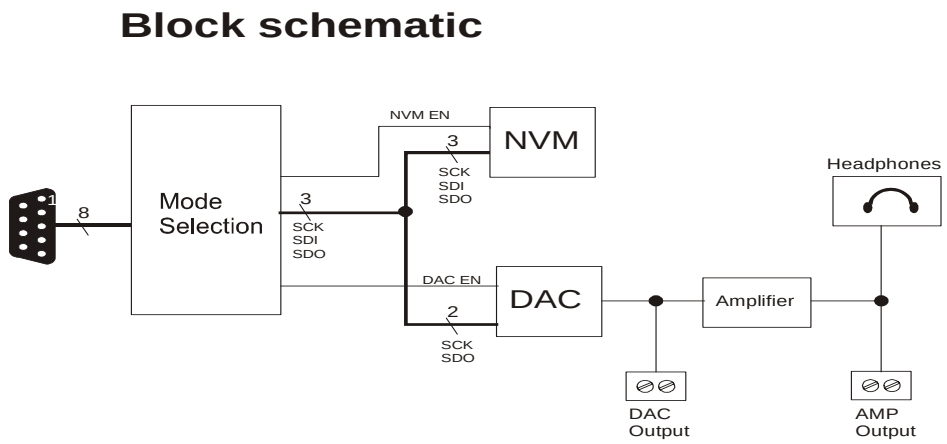
A set of jumper links are available which allow the SPI E-block to easily be set for all PICmicro® microcontroller SPI compatible devices. With the patch system available on board makes this board compatible with numerous other devices.

Flowcode macros that make this device easier to use are available.

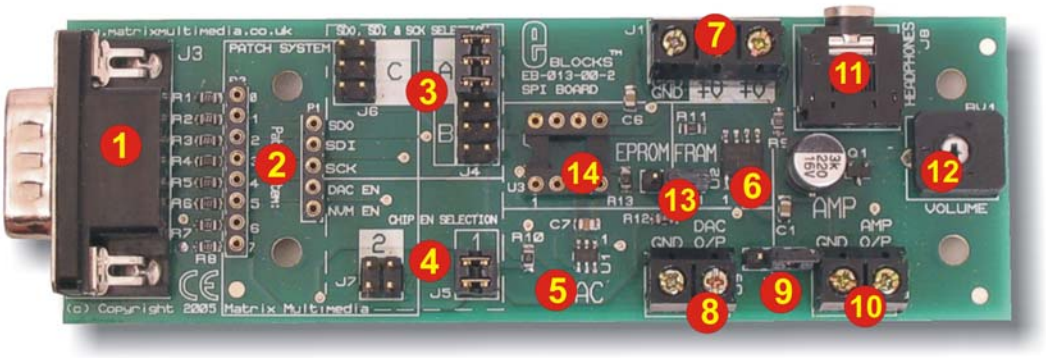
2. Features

- SPI serial Non-Volatile Memory
- SPI serial Digital to Analogue Converter
- Flowcode macros available
- Amplifier output for D / A Converter
- Headphone socket for audio use

3. Block schematic



3. Board layout



EB013-74-2.cdr

1) 9-way downstream D-type connector
2) Patch system
3) SDO, SDI & SCK mode selection jumper pins
4) SPI Chip enable mode selection jumper pins
5) SPI Serial D / A Converter
6) SPI Serial FRAM
7) Power screw terminals
8) D / A Output
9) Amplifier selection jumper pins
10) Amplifier output screw terminal
11) Headphone socket
12) Volume control for amplifier
13) EPROM/FOAM jumper
14) EPROM socket

General Guide for CTS and RTS settings:

Jumper Settings	Description
1	DAC and NVM Chip ENABLE set to bit 7 and 6
2	Patch System

General Guide for SDO, SDI & SCK settings:

Jumper at A		Jumper at B	Jumper at C
PIC16F7x PIC16F7x7 PIC16F87x PIC16F87xA	PIC16C6x PIC16CC7x	PIC16F88 PIC16F87 PIC16F818 PIC16F819	Patch System
Connect to Port C		Connect to Port B	

If using a PIC16F88, insert board to Port B and jumper settings = B & 1

4. Testing this product

The following program will test the circuit. The test file can be downloaded from www.matrixmultimedia.com.

1. System Setup

Multi-programmer board (EB006) with:

EB006 Options	Setting
Power supply	External, 14V
PICmicro device	16F877A
SW1 (Fast/Slow)	Don't care
SW2 (RC/Xtal)	Xtal
Xtal frequency	19.6608MHz
Port A	Switch board EB007
Port B	LED board EB004
Port C	SPI board EB013
Port D	
Port E	
Test program	SPITEST.hex

EB013 Options	Setting
Patch system	A,1
J2 amp enable	RIGHT
J11 FRAM enable	RIGHT
Headphones (J8)	in

NOTE Do not put headphones on – output TOO loud for ears

2. Test Procedure

1) Wire power to all boards.
2) Configure system and board options as above.
3) Download the test program to the Multiprogrammer
4) Press RESET on EB006 Multiprogrammer
5) Adjust the volume control via RV1 before putting headphones on (we recommend not wearing the headphones and leaving the volume as it is for this test).
6) Press SW0 on the Switch Board (EB-007)
    1. This will send a sine wave out from the NVM to the DAC
7) Press SW1 on the Switch Board
    1. This will produce a high frequency triangle wave output from the NVM to the DAC
8) Press SW2 on the Switch Board
    1. This will produce a low frequency triangle wave output from the NVM to the DAC
9) Press SW3 on the Switch Board
    1. This will produce a triangle wave output from the NVM to the DAC
10) Pressing SW4 at any time will turn off the AMP output

This will fully test the functionality of the board

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5. Circuit description

The circuit as can be seen in the circuit diagram below (See Appendix 1 – Circuit diagram), made up of three sections: Connectors, SPI devices (NVM and DAC), and Amplifier circuit.

1. Connectors

The design of this product is to enable you to use it with many standard PICmicro® microcontroller devices. This is achieved by identifying the PICmicro that you are using. Then selecting the corresponding jumper setting on the SPI board. This will configure the board to the correct pin-out for that PICmicro® microcontroller.
Jumper setting A, B, and C are used for selecting the appropriate pins for SDO, SDI and SCK, the dedicated SPI lines.
Jumper settings 1 and 2 are used to set the correct pins for /DAC EN and /NVM EN. Jumper setting 1 will route /DAC EN and /NVM EN to bits 7 and 6, respectively on the port you are using. Jumper setting 2 allows you to route these to any of the 8 bits on the port. Note that /DAC EN and /NVM EN are active low, and therefore become functional when a low signal (0V) is applied to them.

The microcontroller that is being used determines which port and which jumper. For example, if a PIC16F877A is being used, the CAN Board must be connected to Port A, with the jumper settings to A & 1.

The following tables illustrate the correct jumper settings.

Jumper Setting A		Jumper Setting B	Jumper Setting C
PIC16F devices	**PIC16C devices**		
PIC16F72	PIC16C62B	PIC16F87	PATCH SYSTEM
PIC16F73	PIC16C63A	PIC16F88	
PIC16F737	PIC16C65	PIC16F818	
PIC16F74	PIC16C66	PIC16F819	
PIC16F747	PIC16C67		
PIC16F76	PIC16C72A		
PIC16F767	PIC16C73B		
PIC16F77	PIC16C74B		
PIC16F777	PIC16C76		
PIC16F872	PIC16C77		
PIC16F873/A	PIC16C773		
PIC16F874/A	PIC16C774		
PIC16F876/A			
PIC16F877/A			
CONNECT BOARD TO PORT C		CONNECT BOARD TO PORT B	

Table 1. Jumper settings for SDO, SDI & SCK selection.

The following table (Table 2) shows the settings that can be used for DAC EN and NVM EN.

Jumper Setting 1		Jumper Setting 2	
DAC EN	**NVM EN**	**DAC EN**	**NVM EN**
Bit 7	Bit 6	Patch	Patch

Table 2. Jumper settings for DAC EN and NVM EN selection

The Patch System allows the user to route SDO, SDI, SCK, DAC EN and NVM EN to any 8 of the bits that they require. This allows great flexibility, as the user can then use a different device other than specified in Table 1.

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2. SPI devices

Non-Volatile Memory (NVM)

The NVM that is used on this board is FRAM. The device is the FM25640. It is 64Kb FRAM memory device that uses the high-speed industry standard SPI interface.

The memory architecture is organized into 8,192 x 8 bits, which are accessed using a total of four pins: data-in (SI), data-out (SO), clock (SCK) and chip select (/CS). The FRAM device has a superior write cycle to that of the same pin-out EEPROM devices, with no write delays.

For more information on this device please refer to the datasheet, which is located on the ELSAM CD that is supplied with all upstream devices. This information can also be found on our E-Blocks members area website at: www.matrixmultimedia.com/eblocks and also on Ramtron's website at: www.ramtron.com

An FRAM is fitted as standard, however by placing the jumper (J11) onto the EPROM side (left hand side) will disable the FRAM and enable an inserted EPROM (eg 25LC640 device) to be used.

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Digital to Analogue Converter (DAC)

The DAC is an 8-bit digital to analogue converter that operates using an SPI compatible interface. The device is a MAX5385, manufactured by Maxim. The MAX5385 offers full 8-bit performance with less than 1 LSB integral / differential non-linearity error. The MAX5385 has a full-scale output voltage of (0.9 x VDD – 1LSB) with an output buffer of unity gain.

The datasheet of this device can be located on the ELSAM CD that is supplied with all upstream devices. This information can also be found on our E-Blocks members area website at: www.matrixmultimedia.com/eblocks and also on Maxim's website.

Screw terminal J9 allows direct access to the output of DAC. Jumper J2 should be positioned with in link in the section "DAC" labeled on the board to get access to the DAC output at screw terminal J9.

SPI Enable lines

The SPI protocol allows for multiple devices to be connected to the same data (SDI, SDO) and clock lines (SCK). Therefore the each device has a device enable input. When a device is reading or writing data via the SPI lines that device's enable line must be activated. Setting the enable signal low for that device does this.

3. Amplifier

The amplifier circuit is a current amplifier circuit that can be used for audio applications. Screw terminal J10 allows direct access to the amplifier output. To access the amplifier circuit jumper J2 should be positioned so that the link is in the section "AMP" labeled on the board.

The amplifier can be used to drive headphones via the on-board headphone socket J8. The volume of the output can be adjusted using the volume control potentiometer RV1, which also allows correct biasing of the transistor in the amplifier circuit.

The amplifier circuit can be used to drive loudspeakers with load impedance down to 8 Ohms. The loudspeaker should be connected via screw terminal J10. These screw terminals (J10) will give direct access to the amplifier output.

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4. 3.3V operation

The FRAM fitted at the factory is not 3.3V compatible. However users can fit an EPROM (e.g. 25LC540) which is 3.3V compatible. The MAX 5385 D/A is compatible with 3.3V systems.

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Appendix 1 – Circuit diagram