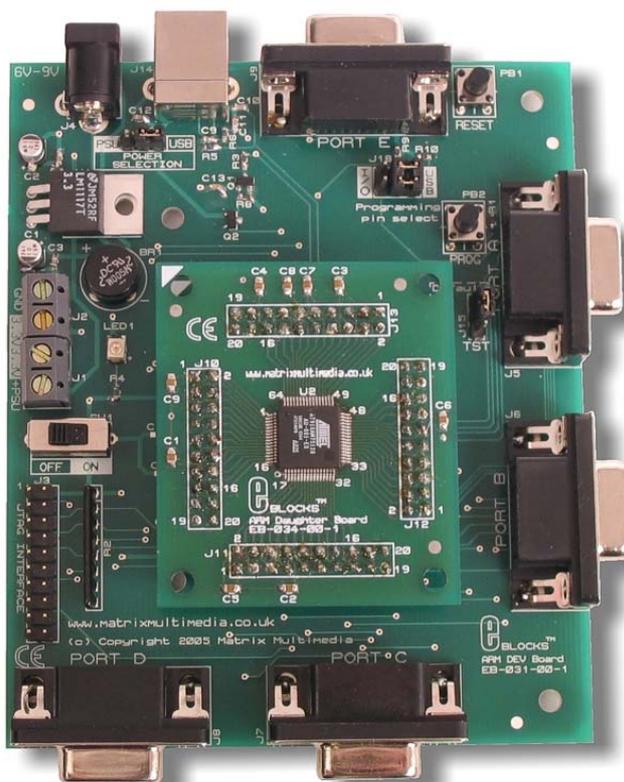


ARM programmer and daughter board EB185-00-1 Technical datasheet



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Appendix 1 Circuit Diagram

1 About this document

This document concerns the E-blocks ARM programmer and daughter board.

The order code for this product is EB185. EB185 is a combination of EB031 ARM mother board and EB034 ARM daughter board.

1.1 Trademarks and copyright

ATMEL and SAM-BA are registered trademarks of the Atmel Corporation.

ARM is a registered trademark of ARM Limited.

E-blocks is a trademark of Matrix Multimedia Limited.

1.2 Other sources of information

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

1.2.1 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.

1.2.2 C and assembly strategies

Not provided for this product.

1.3 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.

1.4 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 .

We have User Forums on the web site for Technical support issues and for users to discuss Matrix products, programming and projects.

For technical support please refer to the Support page on our web site, and our User forums.

2 General information

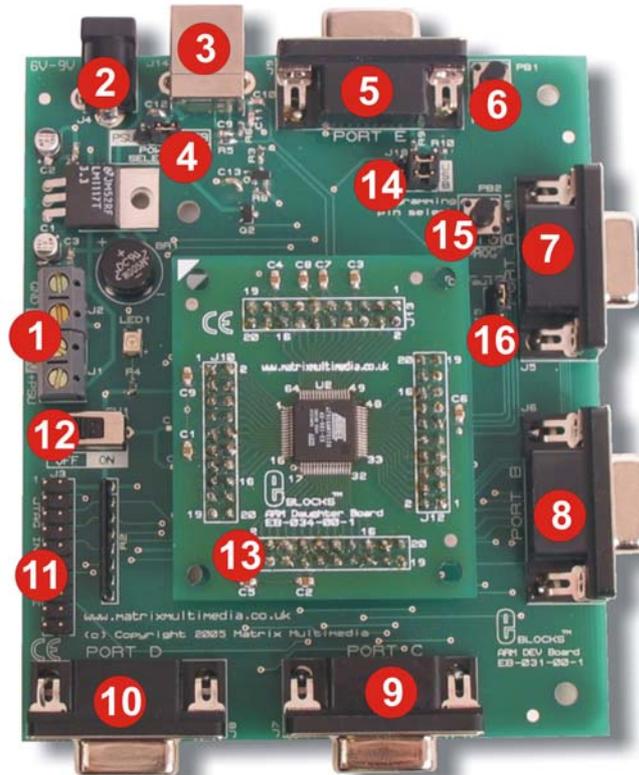
2.1 *Description*

This E-blocks board is a development tool for the powerful AT91 SAM 7 microcontroller from Atmel. The SAM 7 is a 32 bit RISC device running at an internal frequency of 36MHz, and having 128k ROM and 32K static RAM as well as 2 USARTs, 4x 10 bit A/D converters and a native USB bus. This incredibly powerful microcontroller can be used for a range of advanced E-blocks projects. The board has 5 E-blocks ports and the processor itself is housed on a removable daughter board (Atmel ARM processors are only available in SMD technology) so that the ARM can be incorporated into custom PCBs.

2.2 *Features*

- 32 bit RISC processor with 128K ROM and 32K SRAM
- USB programmable with boot loader
- 5 x E-blocks ports, 32 I/O lines
- Compatible with most downstream boards
- Native USB and SPI buses
- Removable crystal

3 Board layout



EB18574-1.cdr

1. Screw terminals
2. Power connector
3. USB connector
4. Power selector link block
5. Port E I/O
6. Reset switch
7. Port A I/O
8. Port B I/O
9. Port C I/O
10. Port D I/O
11. JTAG interface
12. Power switch
13. ARM daughter board
14. Programming selector link block
15. Programming switch
16. Recovery selector link block

4 Testing this product

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

The following instructions explain the steps to test your board. The instructions assume that mLoader is installed and functional. It also assumes that you are confident in sending a program to the ARM via the mLoader programmer software.

4.1 System Setup

ARM programmer board (EB031) with ARM Daughter board attached (EB034):
1 to 5 LED boards can be attached to the Ports in order to view the Test outputs.

EB031 Options	Setting
Power supply	External, 6 - 9V
Xtal frequency	18.432MHz
Port A	LED board EB004
Port B	LED board EB004
Port C	LED board EB004
Port D	LED board EB004
Port E	LED board EB004
Test program	Test.bin

4.2 Required items:

Items required (Hardware):

- EB031 ARM board
- EB034 ARM daughter board attached to EB031
- USB Cable
- EB004 LED boards for testing port outputs.

Items required (Software):

- mLoader ARM programmer software (mLoader_Setup.exe):
- mLoader ARM programmer
- Matrix ARM board USB Driver

Items required (Programs):

- Test program (Test.bin)

4.3 Initial Software Set-up.

If C for ARMs is installed then the mLoader files will have been installed already.

If not run and Install mLoader_Setup.exe which will install mLoader, the Matrix ARM board USB driver, and the Test.bin file.

4.4 Initial USB Driver installation

When first plugged in the board will be detected by the USB bus and reported as a Matrix board. The Add new hardware wizard will then start asking for the USB drivers for the board. The ARM Board USB drivers are pre-installed as part of C for ARMs, Flowcode ARM and the mLoader setup. Select automatic and the drivers should be found automatically. If not then point the driver installer to the 'USB Driver' folder installed as part of mLoader (C:\Program Files\Matrix Multimedia\mLoader\ USB Driver by default).

4.5 The Test program

- 1) Run the 'ARM Test Program' shortcut from the Matrix Multimedia\mLoader program group. The ARM Test program will then appear ready to download the test program.
- 2) Alternatively open the File ARM_TEST.BIN from the mLoader\ARM_TEST folder in mLoader and send the program.
- 3) Set J16 to the PSU position.
- 4) Switch on the ARM board via switch SW1.
- 5) Whilst pressing down the PROG button switch (PB2) tap the RESET (PB1) button switch. This will put the ARM board into programming mode. Release the PROG button switch.
- 6) The LEDs, if attached, will alter to signify programming mode – usually all on.
- 7) Once the program is sent press the RESET (PB1) button to leave Programming mode and run the test program.
- 8) Close the ARM_TEST program.

4.6 ARM Test program details

ARM Test program has two stages which are repeated continuously.

- 1) LEDs on each port light in alternate pairs creating a 1-0-1-0 to 0-1-0-1 pattern. The pattern repeats 5 times
- 2) The entire port flashes on and off. The pattern is repeated 5 times.
- 3) Check on each port to see that both the alternating pattern and the flashing pattern are correct. (Excluding B5, D4 and E4-7 – see notes below).

4.7 Important Notes:

- Pins B5 and D4 are used with caution (they are USB pins and using them causes USB issues).
- Port E only uses pins 0-3. Pins 4-7 are analogue only ports which are not used in this test.
- **The User test requires the ARM board to have the Matrix OS program loaded onto the ARM device.** If the Matrix OS program has not been loaded, or has been overwritten please refer to the *Re-flashing the EB185 ARM Board* section in the EB185-30 Technical datasheet. If the board is listed as a Matrix board in Hardware manager, and when first plugged in, then the Matrix OS is correctly loaded.

5 Circuit description

The ARM Board solution is made up of two parts:

- A mother board (ARM Board EB031) that allows ARM devices to be programmed and the program to be executed ‘seamlessly’
- The ARM daughter board (EB034) that houses the ARM device on a simple to use board. This allows the user to program the device using the ARM Board (EB031) and then either use this daughter board in either the ARM board (EB031) for development, or to easily use the ARM daughter board in another project.

The ARM Board (EB031) acts as a programmer and a development board allowing the powerful ARM processor to be used with other E-Blocks. The following is a description of the features that make up this board.

5.1 **Power Supply**

The board is normally operated from an external regulated DC power supply of 6V – 9V. This allows full operation including programming.

The board has two modes of power supply; either from an external regulated DC power supply or powered using the computer via the USB port. The external power supply is specified as 6 – 9V regulated DC power supply. When using the USB port to power the board, the user must be aware of the limitations for the use of this USB port – for example the limited current that can be supplied via USB (approx 100mA).

The jumper link system, J16, allows the user to decide on the source of the power supply. If using an external power supply the jumper should be positioned to the left hand side of the jumper system labelled ‘PSU’. If using USB power place the jumper on the right hand side of the jumper system. LED1 indicates that power is supplied to the board from either the external power supply or the USB cable.

Please note that both USB and the PSU cables should be removed for the ARM board BEFORE changing the position of this jumper.

Remember that other E-blocks will have to receive 3.3V by placing a connecting wire from the “+V” screw terminal of the ARM Board to the “+V” screw terminal of each E-Block that requires a voltage. Also the user should ensure that all the E-Blocks that they are using are 3.3V compatible.

5.2 **Programming (hardware)**

The ARM Board connects to a personal computer via the USB socket. Any USB socket on the PC can be used. The host ARM device is set-up to communicate with the USB bus and the programming circuitry. The board uses MOSFET transistors to detect the USB bus, which allows the board to be programmed.

The board has a connection (10 + 10 DIL PCB header pins) that allows the ARM device to be programmed via an external programmer using the JTAG pins available on the ARM device. This is a standard JTAG connection.

DIL Sockets and I / O Ports

The ARM board uses an external ARM daughter board. This daughter board enables the ARM board to be both a development board and a programmer. This means that the user can either use the ARM daughter board in the ARM Board for development, or for programming the daughter board which can then be used in other projects.

The ARM board connects to the ARM daughter board (EB034) via four DIL PCB sockets (10 + 10). These connect all the ARM device signals to the ARM daughter board, thus allowing programming and use of all the functions available on the ARM device.

The ARM Board has 5 I/O ports, in the form of 9-way D-type connectors. These allow the ARM Board to be fully compatible with the E-Blocks range. The first four D-type connectors (J5-8) connect all 32 general-purpose I/O from the ARM device. Most of these general-purpose I/O pins have multiple functions – such features as SPI,

USART communication and analogue to digital converters. Please see the datasheet of the actual ARM device that you are using for complete list of functions (www.atmel.com).

The ARM device has four dedicated analogue to digital converters and four general-purpose I/O with analogue functionality. Therefore all these eight signals have been grouped together, on the fifth d-type connector (J9), which can be used as a fully analogue port.

Please note that the four general-purpose I/O are also available on the another D-type connector (J8) and care must be taken to ensure that these signals are not connected to any other device whilst using them on these fully analogue port (J9).

A full table of I/O connections is provided below.

5.3 Programming (software)

There are two ways of getting the ARM board into programming mode:

With the power to the board on press and hold down the PROG button switch. Then quickly press and release the RESET button switch. If your drivers are set up then you will hear Windows give a double tone to indicate a USB device has been discovered.

If you have used D4 or B5 as an output then you may find that the driver gets disassociated. In this case you can use this alternate method:

Turn power to the ARM board off using SW 1. Press and hold the PROG button switch down. Turn power on with SW1, and less than half a second after release the PROG button switch.

5.4 Reset Push Button

PB1 provides a reset by pulling the NRST pin low. This will reset the ARM device thus enabling any program to restart.

Please note that the NRST can be programmed so that the reset pin will not function as a reset. See the datasheet for the ARM device that you are using for more details on disabling the NRST as a reset.

5.5 Frequency Selection

The clock signal for this board is generated from either an internal RC clock signal or the on-board external crystal. The on-board crystal is set to 18.432MHz as this enables the USB synchronisation speed to be correct – as stated by the software specification.

The device can also use an internal PLL to set the frequency for the device. Please see the datasheet of the device for further information regarding using the PLL.

6 Re-flashing the ARM Board

6.1 *When to re-flash*

Re-flashing is only required if the Matrix ARM OS has been deleted or overwritten, or if an updated Matrix OS file has been released. Re-flashing should only be carried out when specifically required as errors and complications may cause the ARM board to stop functioning until properly re-flashed.

In our experience the device can need re-flashing if you reset the ARM half way through a programming cycle – to prevent this please ensure that you give the PC sufficient time to download your program. The symptoms here are that the ARM board appears to be dead and a PROG button with RESET button activation does not work, and neither does a power up PROG button activation work.

General programming is performed without requiring re-flashing. Please refer to the mLoader documentation for general programming instructions.

If the ARM is a new device it may require the default ARM drivers.

These drivers are installed by SAM-BA. Please install SAM-BA before installing the USB drivers for the ARM Board.

6.2 *Required items:*

- SAM-BA ARM Re-flash software
Available on ELSAM 2.0 or later and from ATMEL (www.atmel.com).
- Re-flash programs (ARM_MM.bin and test.bin)

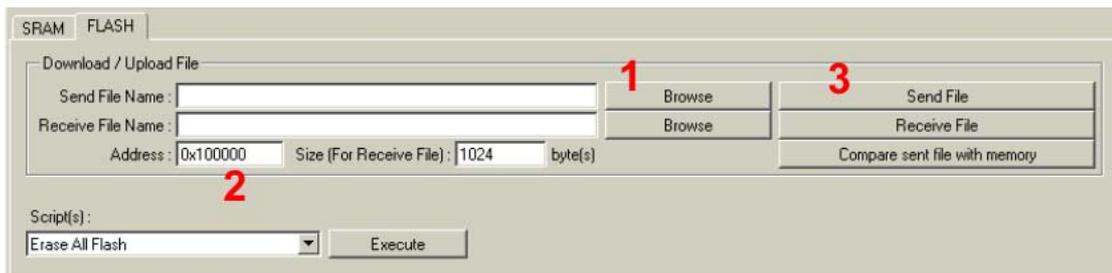
6.3 *Set-up*

The ARM board requires re-flashing to put the Matrix ARM OS onto the ARM board.

1. Re-flashing can be done with USB power only.
2. Check J16 Power selector set to USB
3. Check J18 Programming jumper set to USB
4. Check J15 TST jumper set to Default
5. Plug the board into the PC and turn the power switch SW1 to ON.
6. Check that the Green Power LED is lit.

6.4 *Re-flashing process*

1. Place the TST jumper (J15) to test position – i.e. the bottom pins, straddling the Default box border.
Leave for at least 8-10 seconds.
2. Move SW1 to OFF and replace the TST jumper to the Default position.
3. Move SW1 to ON.
4. Open SAM-BA.
5. Find the USB board in SAM-BA
Select - AT91SAM7S128-EK and click on USB Connection.
A programming dialogue should now appear.
6. In the Middle of the dialogue are the Browse button (1) to locate files, the memory address location (2), and the Send button.



7. Send the test file:
 - Browse to (1) and open file test.bin in the 'C:\program files\Matrix Multimedia\mLoader\Reflasher files' folder.
 - Set the memory location (2) to 0x100000.
 - Send the File
 - Select OK to any Unlock zone/regions messages.
8. Send the Main file:
 - Browse to (1) and open file ARM_MM.bin in the 'C:\program files\Matrix Multimedia\mLoader\Reflasher files' folder.
 - Set the memory location (2) to 0x119000.
 - Send the File
 - Select OK to any Unlock zone messages.
9. Move SW1 to OFF
10. Add LED boards
11. Move SW1 to ON.
12. The LEDs should now be showing alternate pairs creating a 1-0-1-0 to 0-1-0-1 pattern.

The ARM board should now be ready for testing.

Use the test routine detailed earlier to test the ARM board is correctly re-flashed and accepting programs from mLoader.

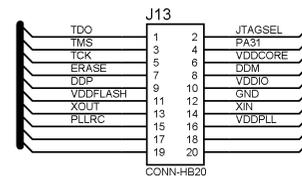
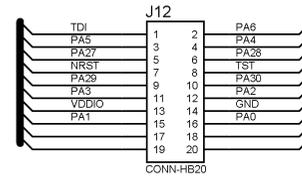
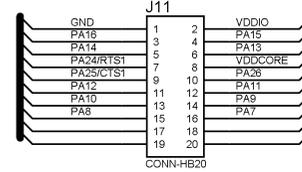
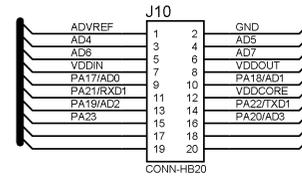
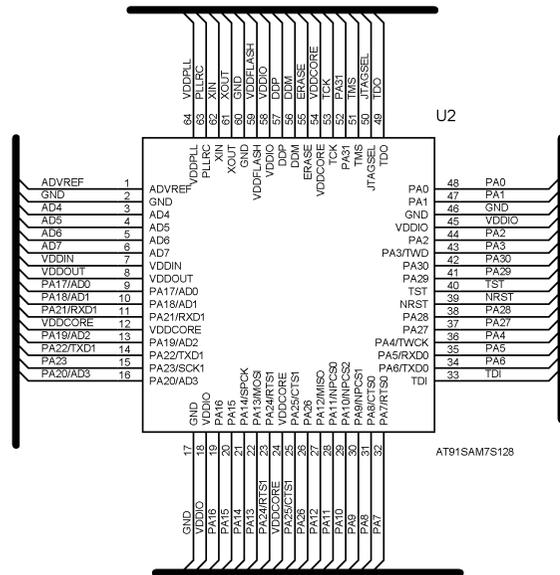
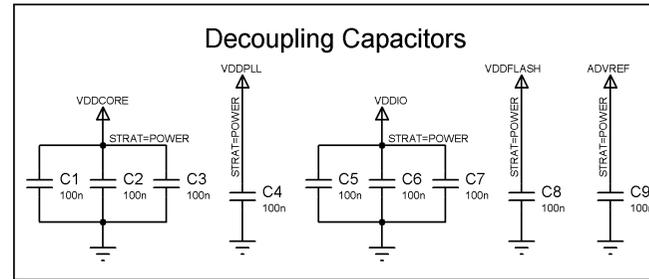
7 Port and Pin list

E-blocks Ports	ARM pin name	ARM pin	Notes
A0	PA0	48	
A1	PA1	47	
A2	PA2	44	
A3	PA3	43	
A4	PA4	36	
A5	PA5	35	
A6	PA6	34	
A7	PA7	32	
B0	PA8	31	
B1	PA9	30	
B2	PA10	29	
B3	PA11	28	
B4	PA12	27	
B5	PA13	22	USB Pin
B6	PA14	21	
B7	PA15	20	
C0	PA24 / RTS1	23	
C1	PA26	26	
C2	PA27	37	
C3	PA28	38	
C4	PA25 / CTS1	25	
C5	PA23	15	
C6	PA22 / TXD1	14	
C7	PA21 / RXD1	11	
D0	PA17 / AD0	9	Also on E0 - Analogue Pin
D1	PA18 / AD1	10	Also on E1 - Analogue Pin
D2	PA19 / AD2	13	Also on E2 - Analogue Pin
D3	PA20 / AD3	16	Also on E3 - Analogue Pin
D4	PA16	19	USB Pin
D5	PA29	41	
D6	PA30	42	
D7	PA31	52	
E0	PA17 / AD0	9	Also on D0 - Analogue Pin
E1	PA18 / AD1	10	Also on D1 - Analogue Pin
E2	PA19 / AD2	13	Also on D2 - Analogue Pin
E3	PA20 / AD3	16	Also on D3 - Analogue Pin
E4	AD4	3	Analogue Pin
E5	AD5	4	Analogue Pin
E6	AD6	5	Analogue Pin
E7	AD7	6	Analogue Pin

7.1 Notes:

- The ARM has a 32 bit IO register and 8 Analogue input lines.
- On the E-blocks ARM board the 32 bit register has been broken down into four ports – Ports A, B, C and D. The pin to port allocation does not correspond directly 0-31 with Ports A-D due to the need to place serial communications pins on the same port (Port C). Please refer to the above Port and Pin list when working with the 32 bit IO register.
- Four of the analogue lines use pins in the 32 bit digital IO port. Four of the analogue lines are separate analogue only lines.
- Port E contains the 8 Analogue input lines. This means that Port E Pins E0-E3 duplicate those of Port D pins D0-D3. Pins E4-E7 are analogue lines only, not general IO.
- Pins B5 and D4 are used in USB Communications. Signals on these lines may affect the USB bus causing erroneous activations of the USB New device added wizard. To prevent this either do not use Pins B5 and D4, or move the Programming Pin Select jumper (J18) to the IO position whilst running the program (move it back to USB for programming).

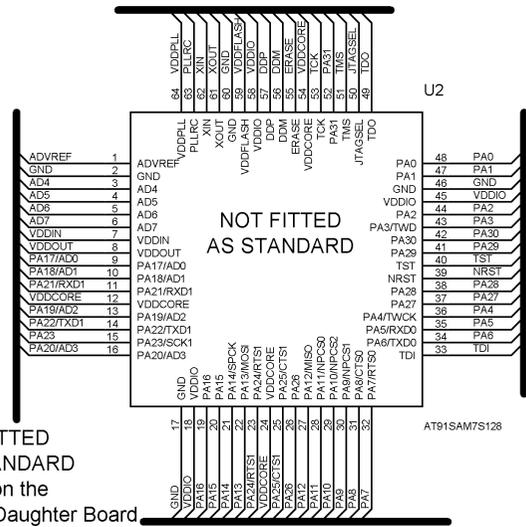
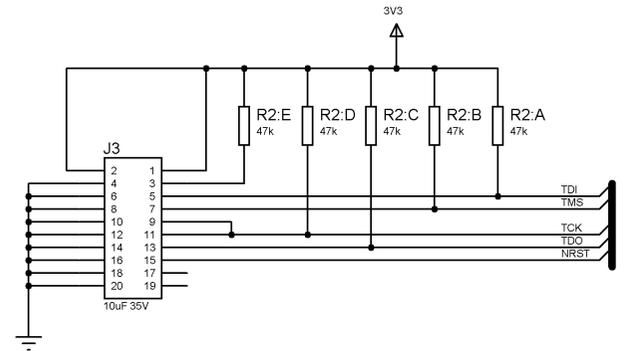
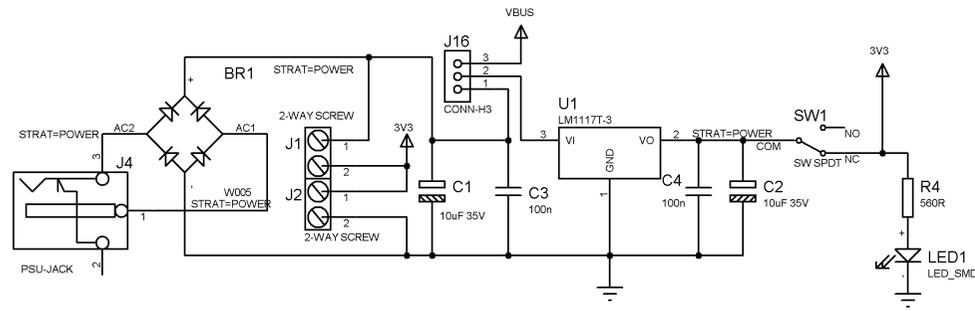
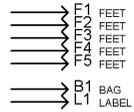
Appendix 1 – Circuit diagram



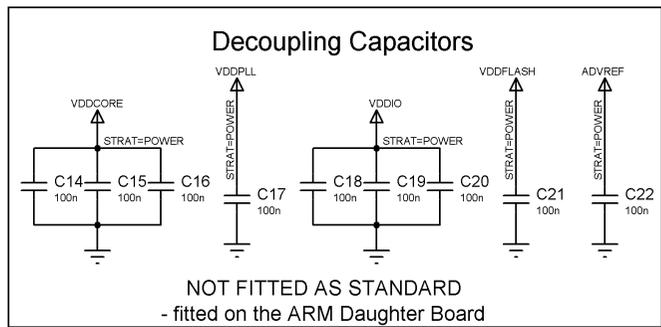
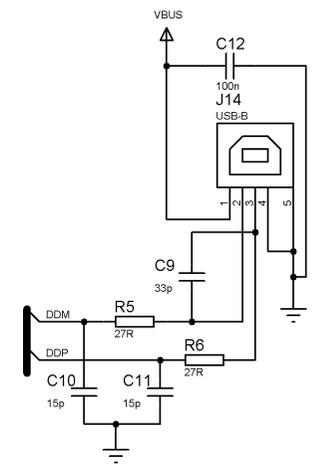
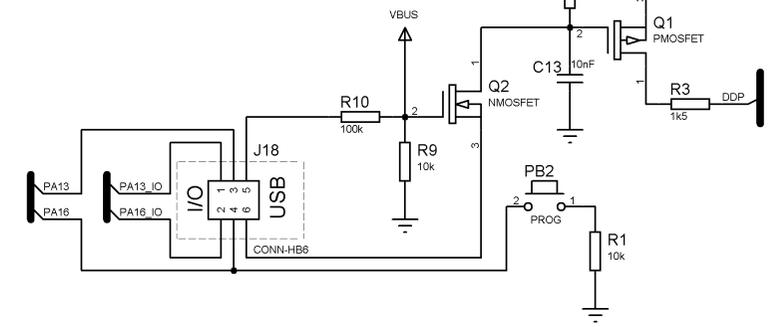
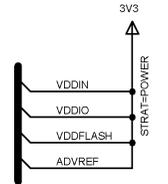
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BY: Conor Carr	REV:

Appendix 1 – Circuit diagram

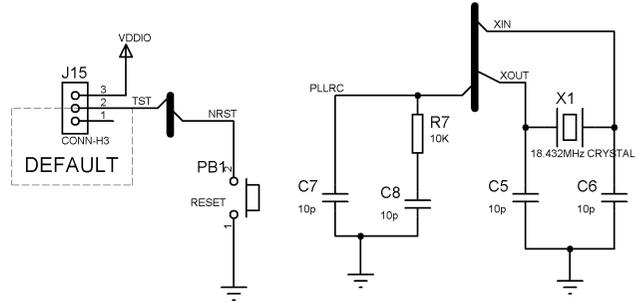
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NOT FITTED AS STANDARD
- fitted on the
- ARM Daughter Board

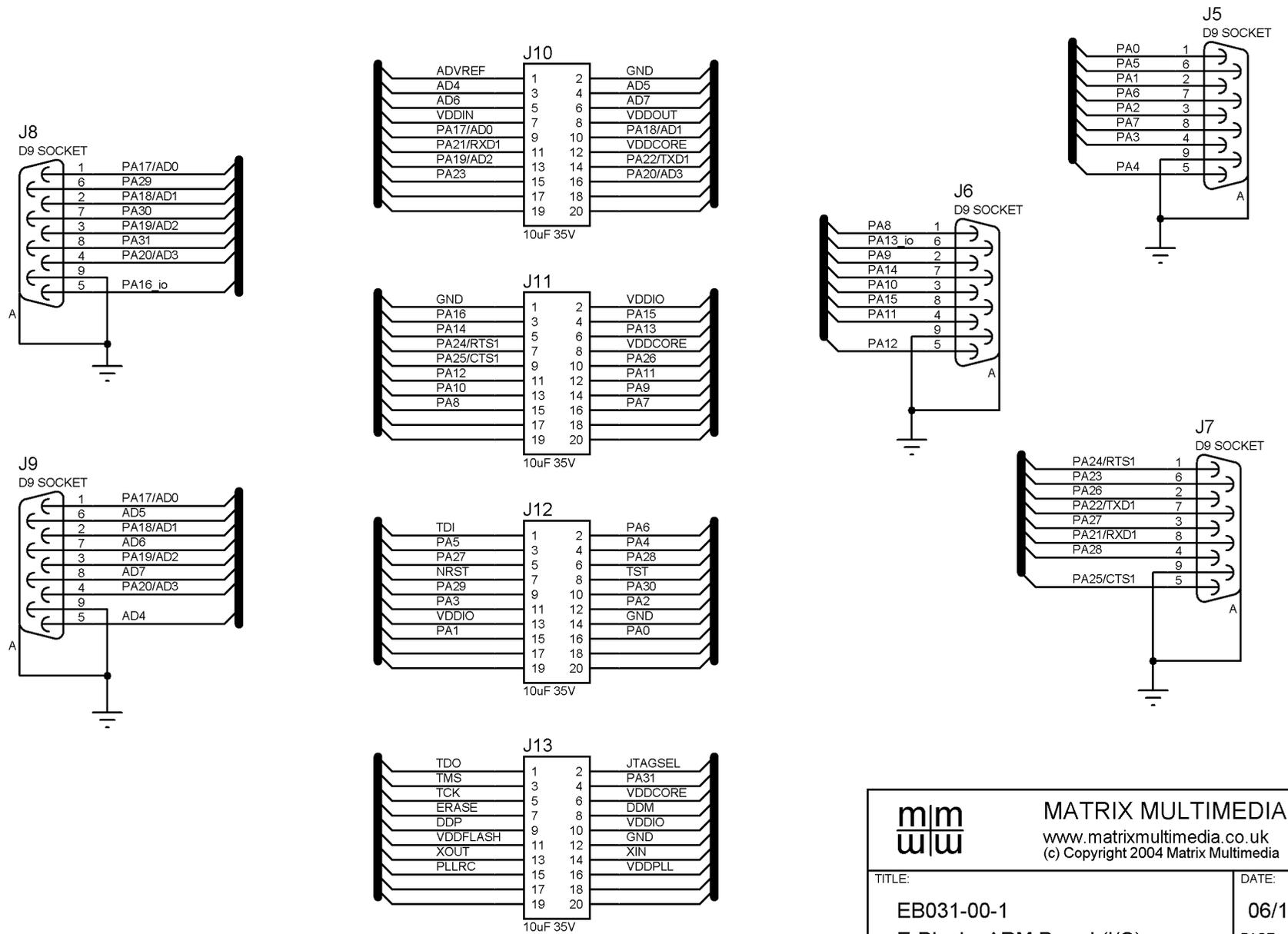


NOT FITTED AS STANDARD
- fitted on the ARM Daughter Board



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Appendix 1 – Circuit diagram



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BY: Conor Carr	REV:	PAGE: 2/2