

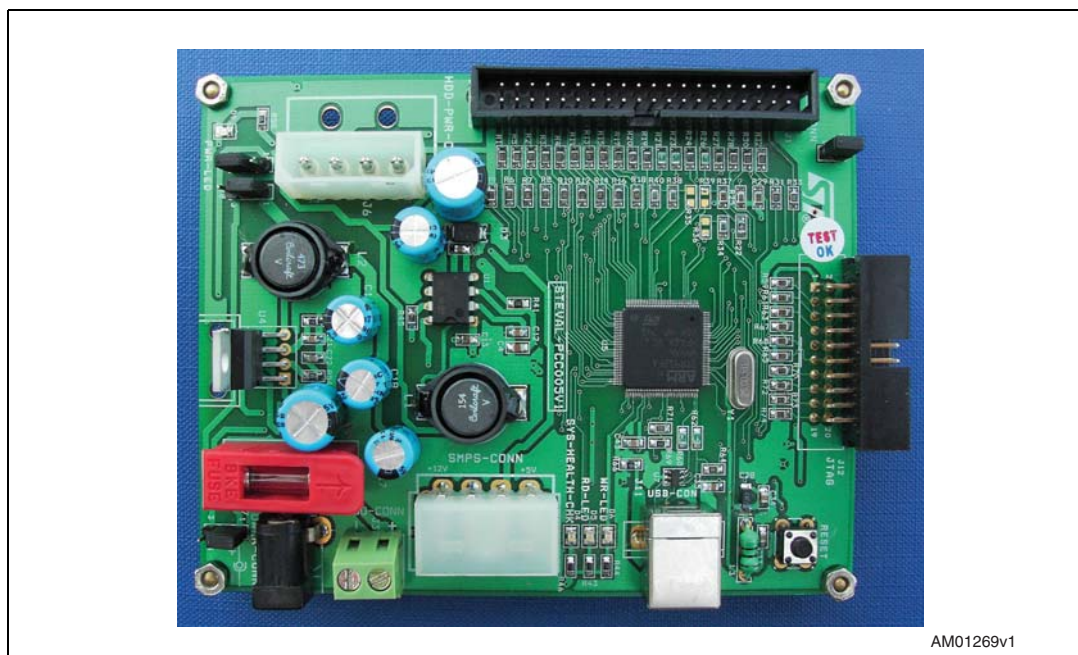
STEVAL-PCC005V1, STR912FAW44 parallel interface to hard disk demonstration board

Introduction

This user manual explains the operation of demonstration board STEVAL-PCC005V1 which implements a parallel interface hard disk on the STR912FAW44 microcontroller (ARM966E-S, 16/32 bit Flash MCU with ethernet, USB, CAN, AC motor control, 4 timers, ADC, RTC, DMA). The hard disk can be applied to any microcontroller within the STR91x family. The various hardware sections of the STEVAL-PCC005V1 are explained in this document. The key features of the STEVAL-PCC005V1, STR912FAW44 parallel interface to hard disk demonstration board are the following:

- Based on the STR912 (ARM966E-S) microcontroller with built-in external memory interface (EMI)
- USB interface available for USB hard disk application
- Acts as a mass-storage device using the drivers of the Microsoft® operating system
- Onboard power supply for hard disk
- Option for using external power supply
- Onboard JTAG connector for microcontroller firmware upgrade and changes
- Additional ESD protection device on USB
- LED indications for power, read and write operations and system health check.

Figure 1. STEVAL-PCC005V1, STR912FAW44 parallel interface to hard disk demonstration board



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1 Getting started

1.1 Package

The STEVAL-PCC005V1, STR912FAW44 parallel interface to hard disk demonstration board includes the following items:

1. Hardware content:
 - Demonstration board
2. Documentation:
 - User manual
3. Microcontroller firmware:
 - The STR912FAW44 device (already programmed) soldered on the demonstration board
 - Object files are also available for the firmware

No PC software nor drivers are required in order to use the Microsoft operating system.

1.2 Setting up the board

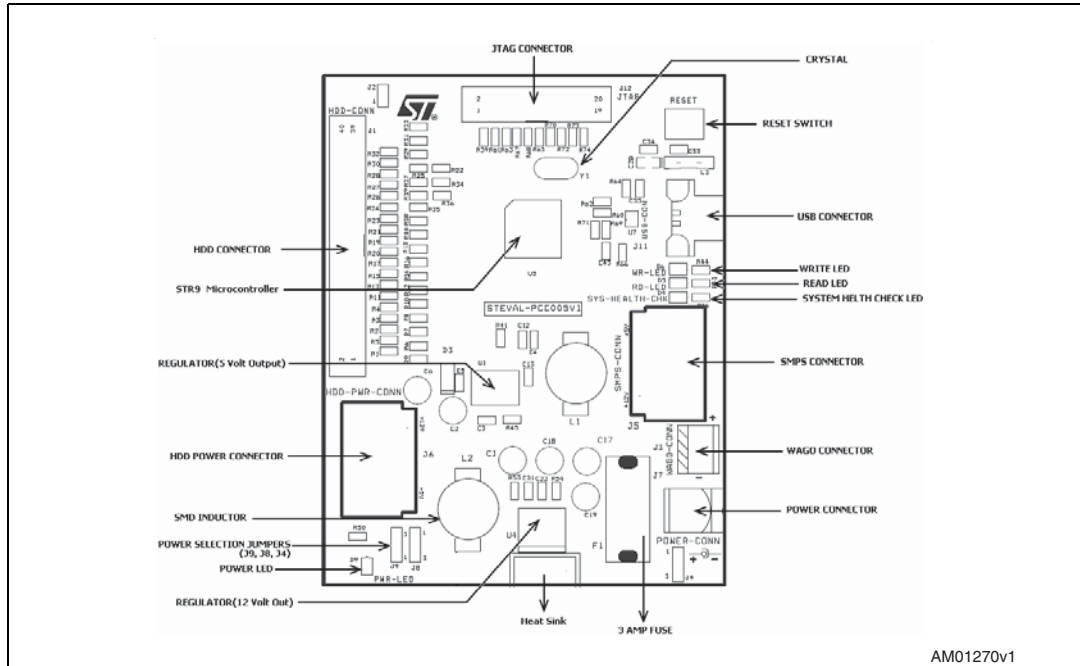
The STR912FAW44 parallel interface to hard disk demonstration board can be set up as follows:

1. Connect the 40-pin IDE data cable between the hard disk and HDD-CONN (J1) of the STR9 interface to the hard disk board.
2. To power on the hard disk as well as the board, set the jumpers according to the available source of power, refer to [Table 1 on page 11](#).
3. Glowing of the SYS_HEALTH_CHK LED (D4) indicates that the board power-on sequence and hard disk initialization have been done correctly.
4. Connect the USB cable between the board and the PC.
5. The PC then shows the hard disk as a removable drive, and the user can access the hard disk as a storage unit.

1.3 Hardware layout

The STR912FAW44 parallel interface to hard disk demonstration board is built around STMicroelectronic's ARM® core-based STR912FW44X6 in a 128-pin LQFP128 package. It also includes switching regulators and a low drop regulator to replace the ATX-SMPS, ultra-low voltage supervisor and ESD protection on the USB bus. [Figure 2 on page 7](#) shows the component layout to help the user to locate different components/sections of the board.

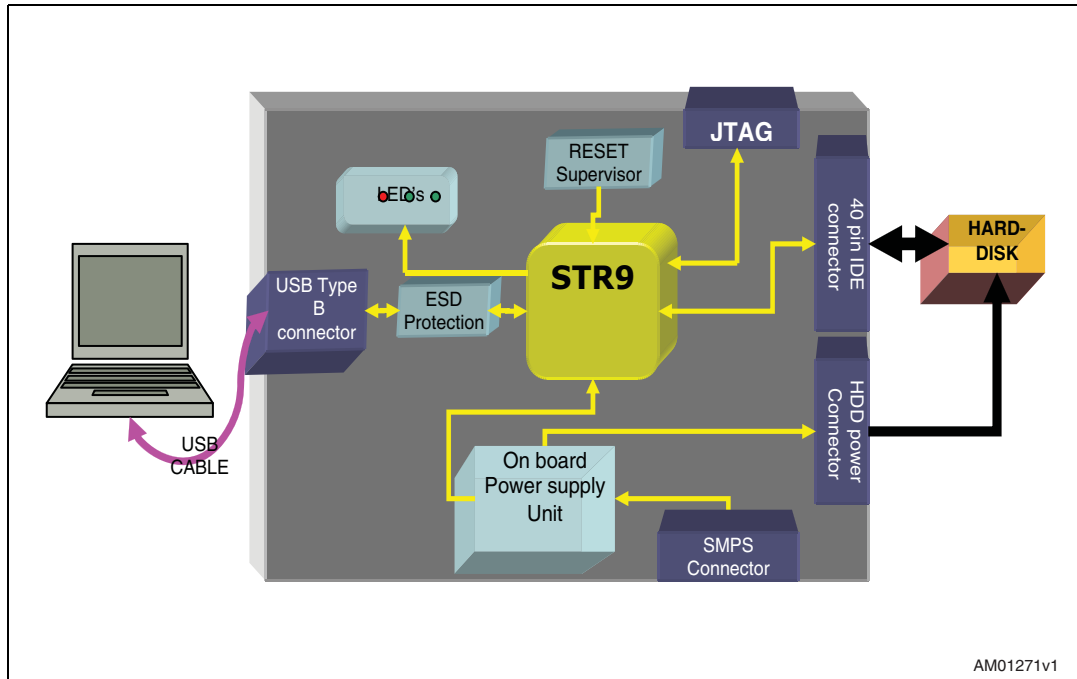
Figure 2. Hardware layout of the demonstration board



2 System overview

2.1 General description of product architecture

Figure 3. System architecture of the demonstration board



2.2 System architecture description

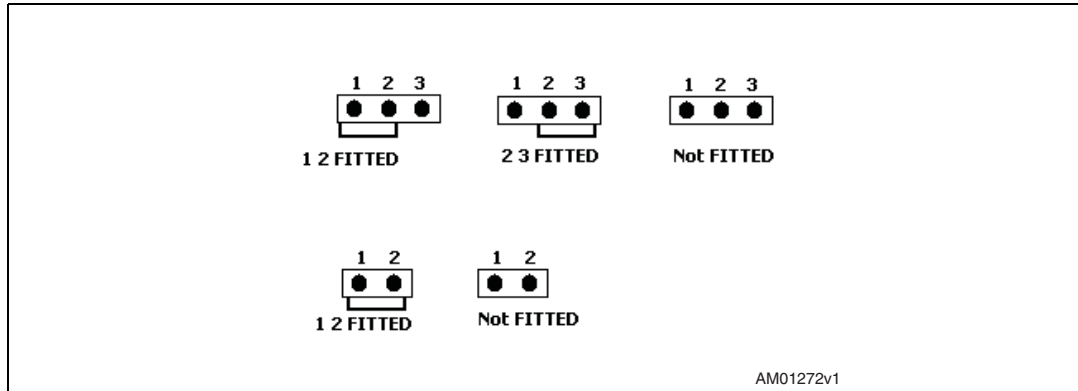
- The board works as a USB-based hard disk implemented on the STR912FAW44 microcontroller
- The STR912FAW44 parallel interface to hard disk demonstration board consists of two main sections. First the interface of the hard disk to STR912FAW44 through an external memory interface (EMI) and second, the hard disk appears as a removable drive on the PC which is made possible by the USB mass-storage implementation
- The hard disk is connected to STR912FAW44 with a built-in EMI module. The EMI is used in 16-bit MUX mode
- The onboard power supply unit can be used for powering the hard disk. This board works with a PC which is the USB host
- In addition to the onboard power supply, a separate SMPS power supply can be used to power the board as well as the hard disk
- LEDs available on the demonstration board indicate read or write operation
- JTAG interface for debugging purposes
- For ESD protection the device is connected between the USB connector and STR912FAW44
- The board consists of a dual, ultra-low reset supervisor and monitors the reset level of the STR912FAW44

3 Design details

3.1 Jumper positions

The following jumper positions are used to explain the different configurations in this document.

Figure 4. Jumper settings



Two types of jumpers are used on the STR912FAW44 interface to hard disk board:

- 3-pin jumpers with two possible positions
- 2-pin jumpers with two possible settings:
 - in the “fitted” position, the circuit is closed
 - in the “not fitted” position, the circuit is open

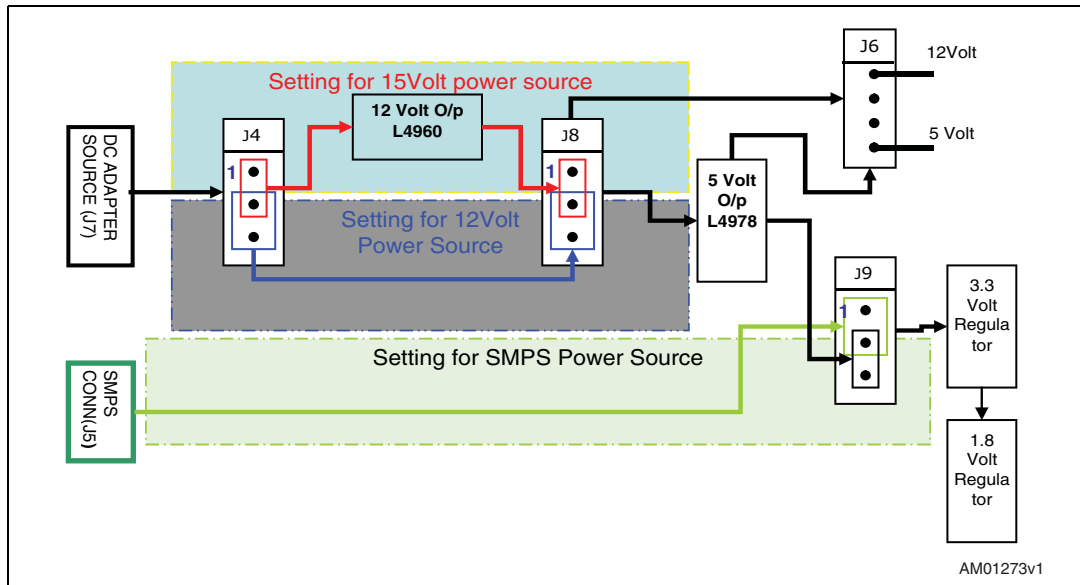
3.2 Power supply

A typical HDD requires both 5 V and 12 V power supplies. The STR912FAW44 interface to hard disk board is designed to be powered by the following three sources according to availability:

- ATX-SMPS provides both 12 V and 5 V supplies (connected to the SMPS connector (J5))
- 12 V DC power adapter connected to the power or WAGO connector (should meet the current ratings of HDD)
- 15 V DC power adapter connected to the power or WAGO connector (should meet the current ratings of HDD).

The power supply is configured by setting the related jumpers and connectors as described in [Table 1 on page 11](#).

Figure 5. Power supply settings



Note: If the device is powered up by SMPS, then the hard disk should also powered by SMPS.

Table 1. Setting up of power supply












Power supply	Description
ATX-SMPS	<p>The board has the option to power from ATX-SMPS. Connect the ATX-PW-ON connector to SMPS_PW_CONN (J5) indicated on the board. Since ATX-SMPS provides 12 V and 5 V needed for the external HDD, there is no need for L4960 and L4978 switching regulators. So, setting the below jumpers isolates the onboard power supply circuit (L4960, L4978) from the HDD.</p> <p>Jumper settings are as follows:</p> <ul style="list-style-type: none"> – J4: open <div style="text-align: center;">  <p>Not FITTED</p> </div> <ul style="list-style-type: none"> – J5: external SMPS power-on connector is connected – J6: open (not used) <div style="text-align: center;">  <p>Not FITTED</p> </div> <ul style="list-style-type: none"> – J8: open <div style="text-align: center;">  <p>Not FITTED</p> </div> <ul style="list-style-type: none"> – J9: connect the jumper between pin 1 and 2 <div style="text-align: center;">  <p>1 2 FITTED</p> </div>
12 V DC power (this should meet the hard disk current requirements)	<p>The board has a power-on provision using a 12 V DC adapter. Connect the 12 V DC adapter to J3 or J7. Since we are using 12 V directly, there is no need for an L4960 switching regulator.</p> <p>Jumper settings are as follows:</p> <ul style="list-style-type: none"> – J7 or J3: 12 V DC adapter is inserted – J5: open (not used) – J4: connect the jumper between pin 2 and 3 <div style="text-align: center;">  <p>2 3 FITTED</p> </div> <ul style="list-style-type: none"> – J8: connect the jumper between pin 2 and 3 <div style="text-align: center;">  <p>2 3 FITTED</p> </div> <ul style="list-style-type: none"> – J9: connect the jumper between pin 2 and 3 <div style="text-align: center;">  <p>2 3 FITTED</p> </div> <ul style="list-style-type: none"> – J6: power on the external hard disk by connecting the hard disk power-on connector between J6 and the hard disk

Table 1. Setting up of power supply (continued)

Power supply	Description
15 V DC power (this should meet the hard disk current requirements)	<p>Connect the 15 V DC power adapter to J7 or J3. Jumper settings are as follows:</p> <ul style="list-style-type: none"> – J7 or J3: 15 V DC adapter is inserted  <ul style="list-style-type: none"> – J4: connect the jumper between pin 1 and 2  <ul style="list-style-type: none"> – J5: open (not used) – J8: connect the jumper between pin 1 and 2  <ul style="list-style-type: none"> – J9: connect the jumper between pin 2 and pin 3  <ul style="list-style-type: none"> – J6: power on the external hard disk by connecting the hard disk power-on connector between J6 and the hard disk
D9 LED	The LED glows when the system gets 5 V power supply

3.2.1 Onboard power supply

The L4960 is a monolithic power switching regulator delivering 2.5 A at a voltage varying from 5 V to 40 V in step-down configuration. This is used to provide the 12 V output required for the external HDD.

The L4978 is a step-down monolithic power switching regulator delivering 2 A at a voltage between 3.3 V and 50 V. This is used to provide the 5 V output required for the external HDD.

To power on the microcontroller 1.8 V and 3.3 V power supplies are also provided. The LD1117A is a low drop voltage regulator able to provide up to 1 A of output current, used for the 3.3 V STR91xF I/O power supply. The LDS3985 is a low drop voltage regulator. Low quiescent current and low noise make it suitable for low power applications and is used for the 1.8 V STR91xF CPU core power supply.

3.3 Microcontroller

The STR912FW44X6 ARM core-based ARM966E-S in a 128-pin LQFP package is the heart of the STR912FAW44 parallel interface to hard disk demonstration board. For this microcontroller two power supplies are required: 1.8 V +/- 10% (for the core) and 2.7 to 3.6 V (for the IO).

The microcontroller offers an external memory bus for connecting external parallel peripherals and memories. The EMI bus resides on ports 7, 8, and 9 and operates with

either an 8 or 16-bit data path. Here the device is configured in 16-bit MUX mode to connect with the external hard disk.

The STR91xFA provides a USB device controller that implements both the OSI physical and data link layers (complicated) for direct bus connection by an external USB host on pins USBDP and USBPN.

3.4 Reset circuit

The reset signal of STR912FAW44 is an active low signal. The reset source includes

- Power-on reset from STM6718TW
- Reset button (SW1)

The STM6718TW supervisors are a family of low voltage/low supply current processor supervisors, designed to monitor two (or three) system power supply voltages. The purpose of this IC is to monitor the core voltage (1.8 V) and IO peripheral voltage (3.3 V). The reset button (SW1) is provided to manually reset the board.

3.5 Clock source

The 25 MHz crystal is connected between the X1 and X2 pin of the microcontroller to provide the clock to the device.

3.6 USB

The STR912FAW44 parallel interface to hard disk demonstration board supports USB 2.0 compliant full speed communication via a USB type-B connector (J11). The USBLC6-2SC6 is a monolithic application specific device dedicated to ESD protection of high speed interfaces such as USB2.0, ethernet links and video lines. Here this device is connected between the USB connector and microcontroller.

3.7 LED indicators

- SYS-HEALTH-CHK LED (D4): This LED indicates the board is properly powered up as well as the correct initialization of the connected hard disk.
- RD-LED (D5): This LED blinks when a read operation is performed on the hard disk.
- WR-LED (D6): This LED blinks when a write operation is performed on the hard disk.

4 Connector details

4.1 Power connector

The STR912FAW44 parallel interface to hard disk demonstration board can be powered up by having ATX-SMPS (J5), a 12 V, or a 15 V power supply connected via an external power supply jack (J7). The current rating should meet the hard disk ratings. Usually 15 V 2 A (or 12 V 2 A) adapters are suitable.

Figure 6. Power supply connector

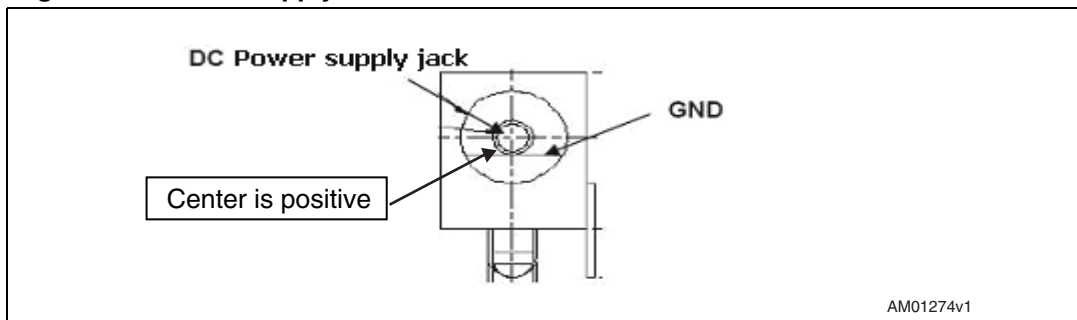


Figure 7. ATX-SMPS connector



4.2 USB type B connector CN3

Figure 8. USB connector

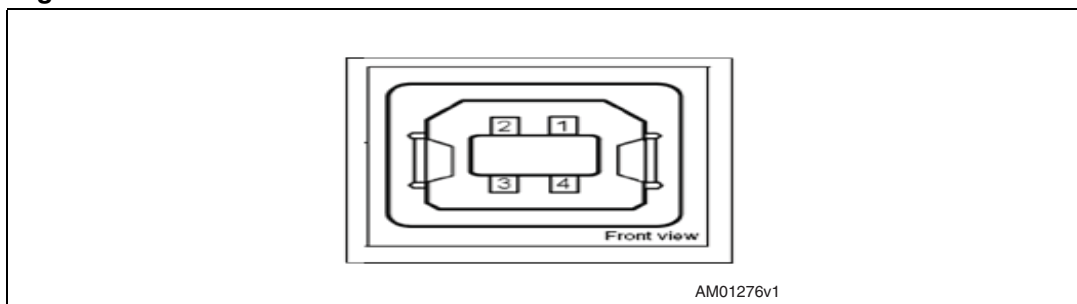


Table 2. Pin description of USB connector

Pin number	Description	Pin number	Description
1	VBUS (power)	4	GND
2	DM	5	SHIELD
3	DP	6	SHIELD

4.3 JTAG connector

Figure 9. JTAG connector

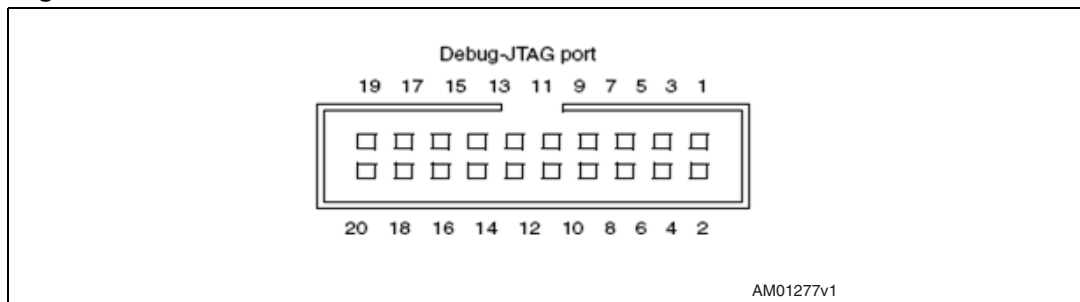


Table 3. Pin description of JTAG connector

Pin number	Description	Pin number	Description
1	3.3 V power	2	3.3 V power
3	TRST	4	GND
5	TDI	6	GND
7	TMS	8	GND
9	TCK	10	GND
11	RTCK	12	GND
13	TDO	14	GND
15	nSRST	16	GND
17	DBGRQ	18	GND
19	DBGACK	20	GND

The JTAG connector is available on the board for reprogramming the microcontroller and debugging.

4.4 Hard disk connector (J1)

Figure 10. Hard disk interface connector

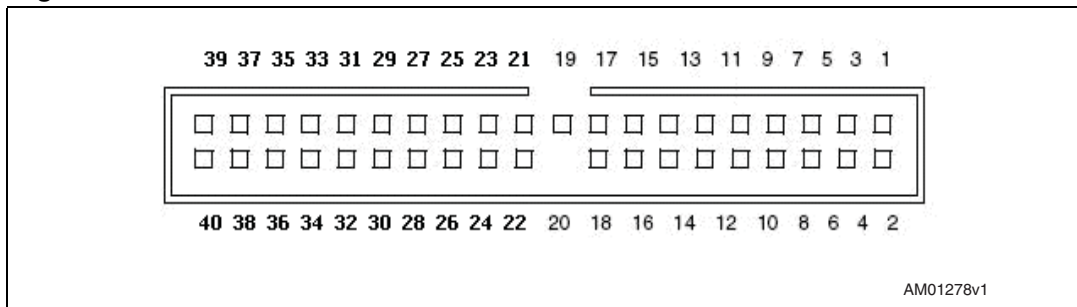
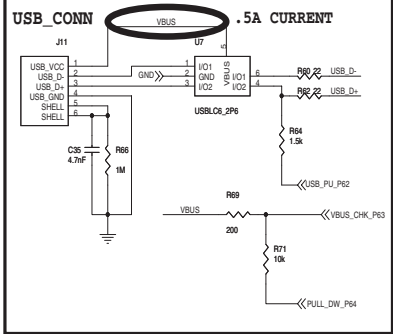
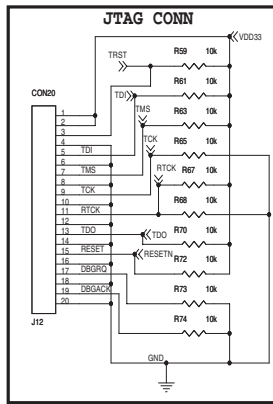
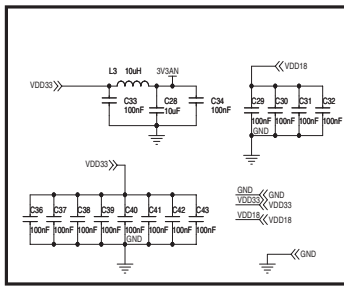
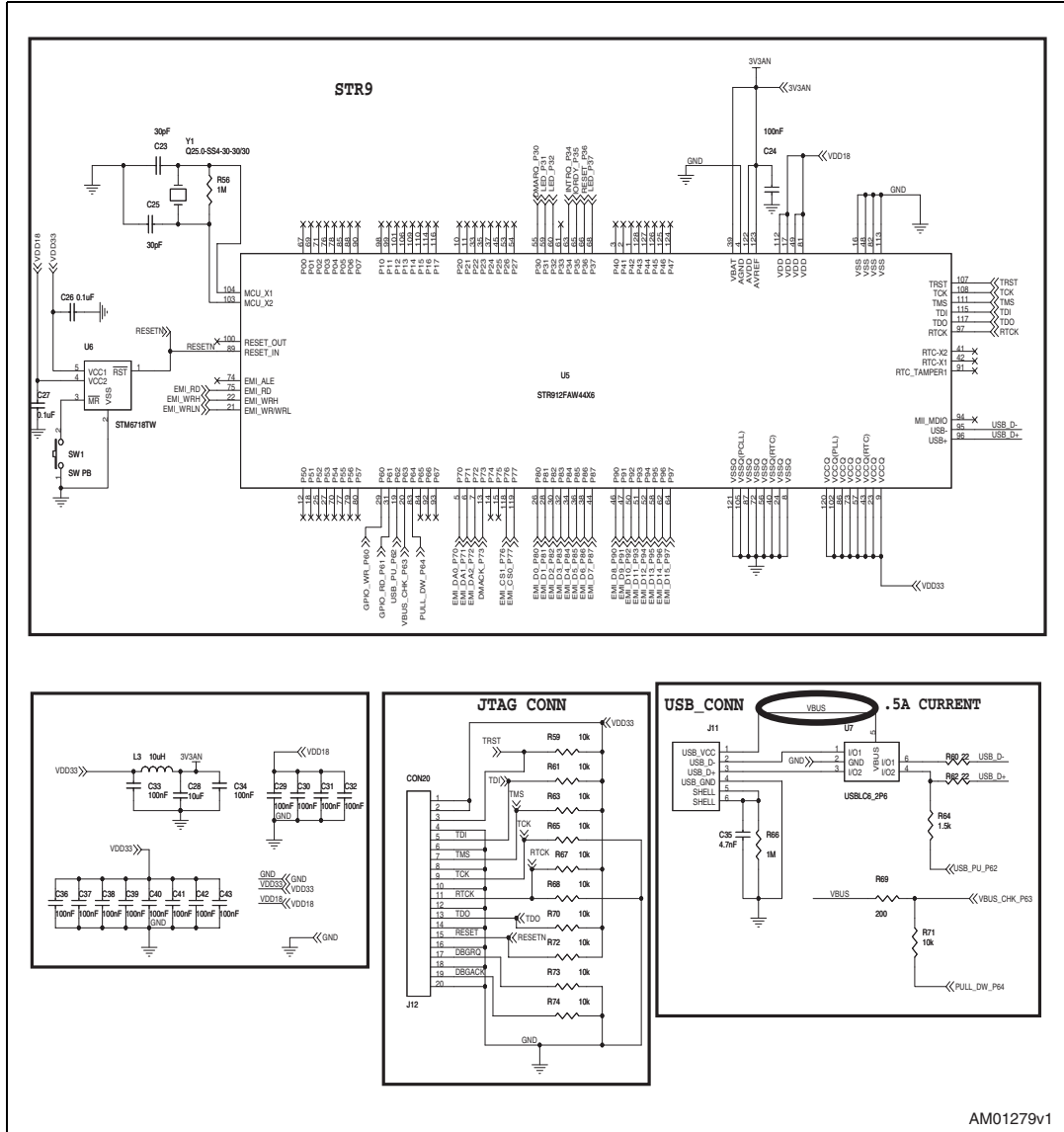


Table 4. Pin description of hard disk interface connector

Pin number	Description	Pin number	Description
1	RESET	2	GND
3	DATA7	4	DATA8
5	DATA6	6	DATA9
7	DATA5	8	DATA10
9	DATA4	10	DATA11
11	DATA3	12	DATA12
13	DATA2	14	DATA13
15	DATA1	16	DATA14
17	DATA0	18	DATA15
19	GND	20	KEY
21	DMARQ	22	GND
23	DIOW-	24	GND
25	DIOR-	26	GND
27	IORDY	28	CSEL
29	DMACK-	30	GND
31	INTRQ	32	IOCS16-
33	DA1	34	PDIAG-
35	DA0	36	DA2
37	CS0-	38	CS1-
39	DASP-	40	GND

5 Schematics

Figure 11. STR912FAW44 IC, JTAG and USB connectors



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Figure 12. Hard disk connector with termination resistor

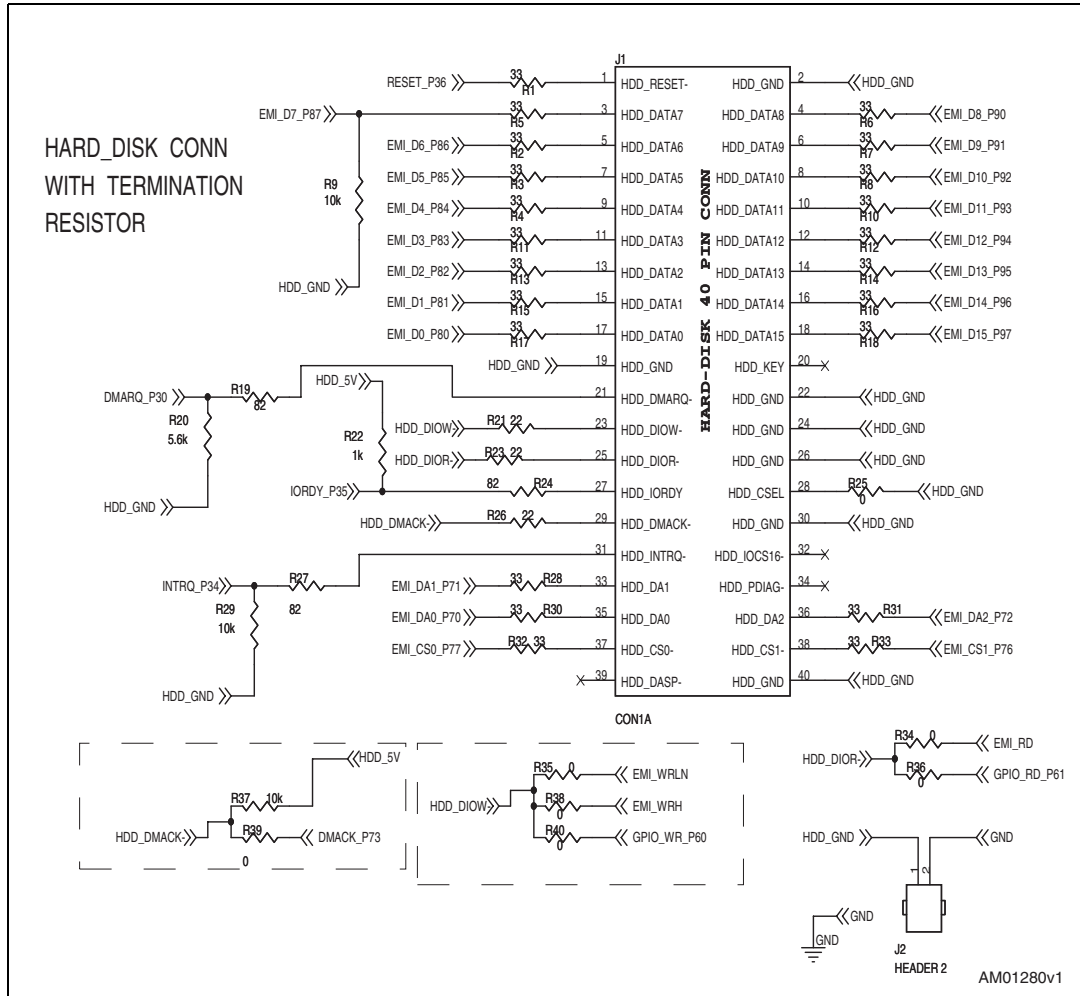
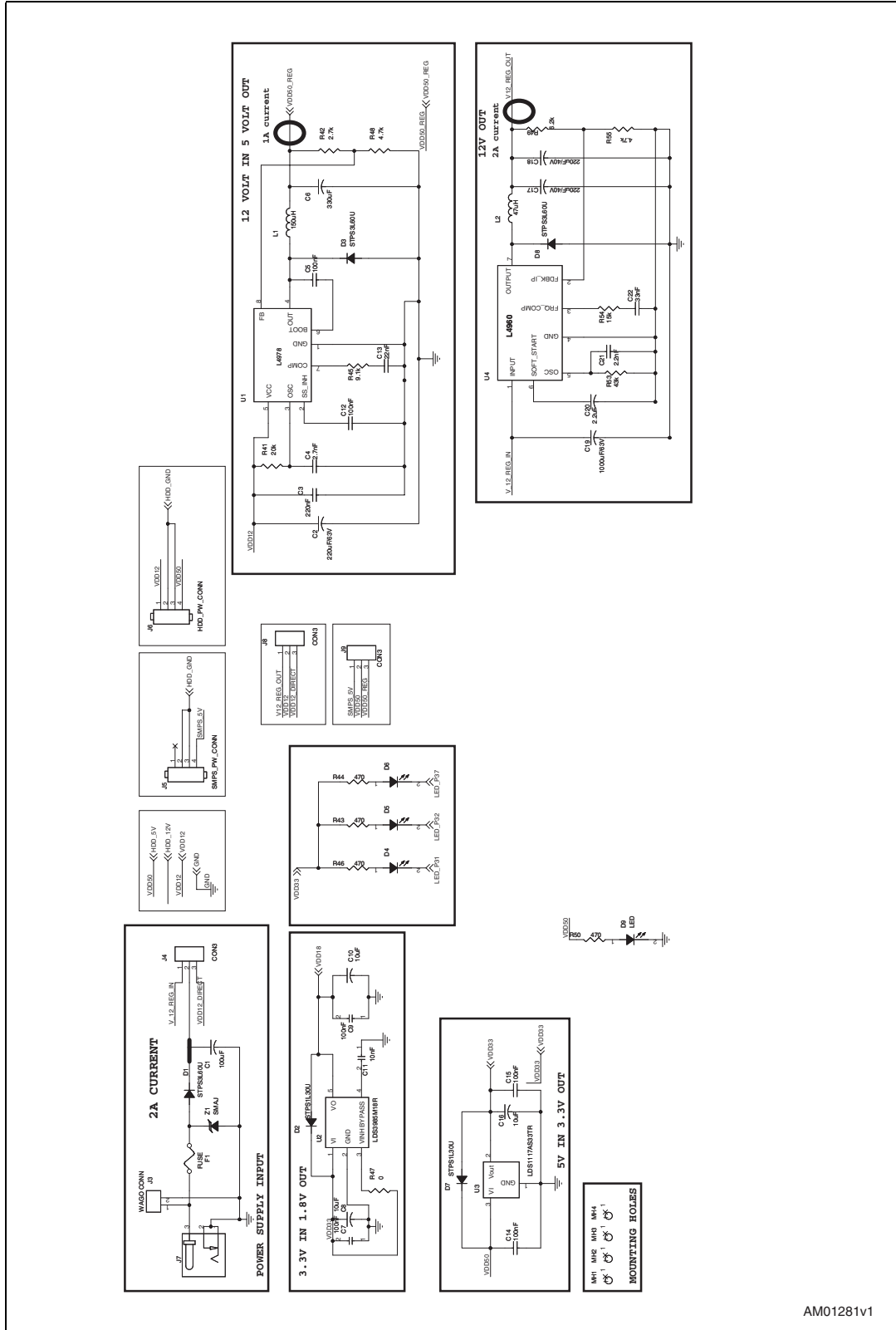


Figure 13. Power management section



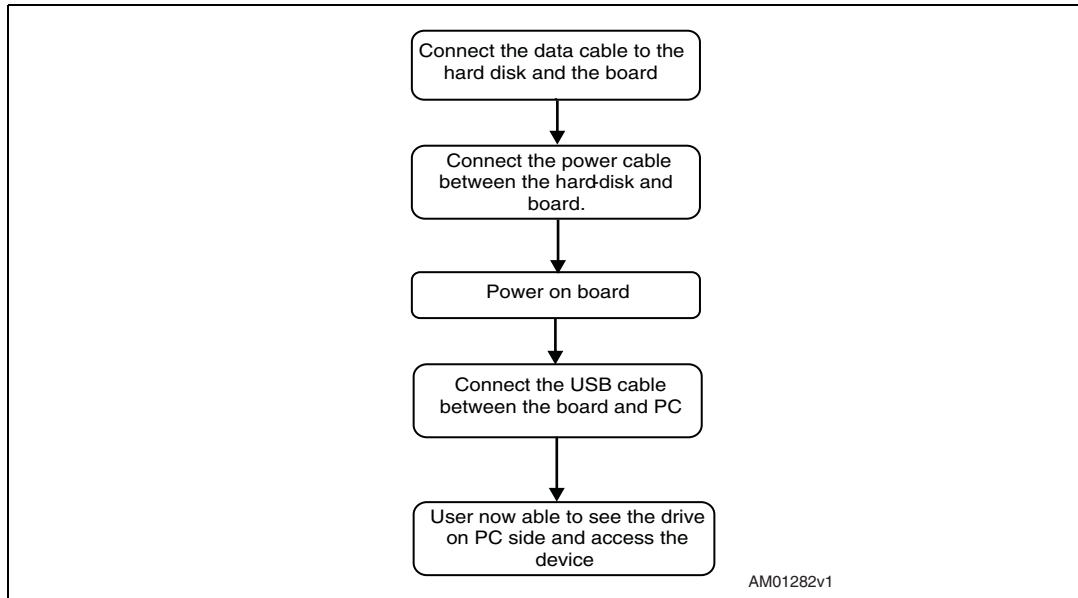
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6 User interface flow

6.1 Power-on sequence

Figure 14. Power-on sequence flowchart



7 Bill of material

Table 5. Bill of material

S. no.	Reference designator	Component description	Package	Manufacturer	Manufacturer's ordering code / orderable part number	Qty
1	U1	L4978 switching regulator	DIP-8	STMicroelectronics	L4978	1
2	U2	LDS3985M18R low drop low noise voltage regulator	SOT23-5L	STMicroelectronics	LDS3985M18R	1
3	U3	LD1117AS33TR low drop voltage regulator	DPAK	STMicroelectronics	LD1117AS33TR	1
4	U4	L4960 power switching regulator	Heptawatt	STMicroelectronics	L4960	1
5	U5	Microcontroller	LQFP128	STMicroelectronics	STR912FAW44 X6	1
6	U6	STM6718TW ultra-low voltage supervisors	SOT23-5 (WY)	STMicroelectronics	STM6718TWW Y6F	1
7	U7	USBLC6_2P6 very low capacitance ESD protection	SOT23-6L	STMicroelectronics	USBLC6-2P6	1
8	Z1	Transil TM	DO-214AC	STMicroelectronics	SMAJ18A-TR	1
9	D1,D3,D8	STPS3L60U (power Schottky rectifier)	SMB	STMicroelectronics	STPS3L60U	3
10	D2,D7	STPS1L30U (low drop power Schottky rectifier)	SMB	STMicroelectronics	STPS1L30U	2
11	Y1	Crystal: Q25.0-SS4-30-30/30	11.35 mm x 4.35 mm SS4	Jauch	Q 25.0-SS4-30-30/30	1
12	SW1	Pushbutton switch	Through hole	Any		1
13	J1	CON1A	Header 2 x 20-pin, 2.54 mm x 2.54 mm pitch	Any		1
14	J2	Header 2	Jumper 2-pin, 2.54 mm pitch	Any		1
15	J3	WAGO CONN	Through hole	Any		1
16	J4,J8,J9	CON3	Through hole	Any		3
17	J6	HDD_PW_CONN	Through hole	Any		1
18	J5	SMPS_PW_CONN	Through hole	Any		1
19	J7	POWER JACK - right angle	14.17 x 8.96 mm	CUI	PJ-102B	1

Table 5. Bill of material (continued)

S. no.	Reference designator	Component description	Package	Manufacturer	Manufacturer's ordering code / orderable part number	Qty
20	J11	USB_CON	USB type B	Any		1
21	J12	CON20 (JTAG connector header)	Right angle header 2 x10 2.54 mm x 2.54 mm pitch	Any		1
22	F1	Fuse holder with cartridge fuses (3 A)	Through hole	Any		1
23	D4,D5,D6,D9	LED	SMD	Any		4
24	C1 (electrolytic capacitor)	100 µF/25 V	ELC (bulk radial)	Any		1
25	C2,C17,C18 (electrolytic capacitor)	220 µF/35 V	ELC (bulk radial)	Any		3
26	C6,C19 (electrolytic capacitor)	330 µF/35 V	ELC (bulk radial)	Any		2
27	C8,C10,C16, C28 (ceramic capacitor 0805)	10 µF	EIA 3528-21/ size B	Any		4
28	C20 (ceramic capacitor 0805)	2.2 µF	EIA 3528-21/ size B	Any		1
29	C3 (ceramic capacitor 0805)	220 nF	SMD0805	Any		1
30	C4 (ceramic capacitor 0805)	2.7 nF	SMD0805	Any		1
31	C5,C7,C9,C12,C14, C15,C24,C26,C27, C29,C30,C31,C32, C33,C34,C36,C37, C38,C39,C40,C41, C42,C43 (ceramic capacitor)	100 nF	SMD0805	Any		21
32	C11 (ceramic capacitor 0805)	10 nF	SMD0805	Any		1
33	C13 (ceramic capacitor 0805)	22 nF	SMD0805	Any		1
34	C21 (ceramic capacitor 0805)	2.2 nF	SMD0805	Any		1
35	C22 (ceramic capacitor 0805)	33 nF	SMD0805	Any		1
36	C23,C25 (ceramic capacitor 0805)	30 pF	SMD0805	Any		2

Table 5. Bill of material (continued)

S. no.	Reference designator	Component description	Package	Manufacturer	Manufacturer's ordering code / orderable part number	Qty
37	C35 (ceramic capacitor 0805)	4.7 nF	SMD0805	Any		1
38	L1 (inductor)	150 μ H	SMD	Coil-craft	DS5022P-154ML	1
39	L2 (inductor)	47 μ H	SMD	Coil-craft	DS5022P-473ML	1
40	L3 (inductor)	10 μ H	through hole	Any		1
41	R1,R2,R3,R4,R5,R6,R7,R8,R10,R11,R12,R13,R14,R15,R16,R17,R18,R28,R30,R31,R32,R33	33 Ω	SMD0805	Any		22
42	R9,R29,R37,R59,R61,R63,R65,R67,R68,R70,R71,R72,R73,R74	10 k Ω	SMD0805	Any		14
43	R19,R24,R27	82 Ω	SMD0805	Any		3
44	R20	5.6 k Ω	SMD0805	Any		3
45	R21,R23,R26,R60,R62	22 Ω	SMD0805	Any		5
46	R22	1 k Ω	SMD0805	Any		1
47	R25,R34,R35,R36,R38,R39,R40,R47	0	SMD0805	Any		8
48	R41	20 k Ω	SMD0805	Any		1
49	R42	2.7 k Ω	SMD0805	Any		1
50	R43,R44,R46,R50	470	SMD0805	Any		4
51	R45	9.1 k Ω	SMD0805	Any		1
52	R48,R55	4.7 k Ω	SMD0805	Any		2
53	R49	6.2 k Ω	SMD0805	Any		1
54	R53	43 k Ω	SMD0805	Any		1
55	R57	15 k Ω	SMD0805	Any		1
56	R66,R56	1 M Ω	SMD0805	Any		2
57	R64	1.5 k Ω	SMD0805	Any		1
58	R69	200 Ω	SMD0805	Any		1

Appendix A Abbreviations

Table 6. Abbreviations

Term	Description
USB	Universal serial bus
EMI	External memory interface
HDD	Disk drive
JTAG	Joint test action group
SMPS	Switched-mode power supply
ATX	Advanced technology extended
OSI	Open systems interconnection
IC	Integrated circuit
ESD	Electrostatic discharge

Revision history

Table 7. Document revision history

Date	Revision	Changes
21-Apr-2009	1	Initial release

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