code_red™

RDB1768V2 Development Board
User Manual

2/27/2010
Rev.1

1 OVERVIEW

The RDB1768V2 Evaluation Board gives a solid development platform for the development of systems around the NXP LPC1768 Cortex-M3 based Microcontroller. The LPC1768 is the 'superset' part of the LPC17xx family, and therefore the RDB1768 makes an excellent development board for the whole LPC17xx family of parts.

The board allows the rapid prototyping of embedded systems through the use of the on-board peripheral interfaces and supplied example software, or by connecting external hardware to the IO pads.

1.1 LPC1768 Features

- 512K Bytes of on-chip FLASH
- 64K Bytes on-chip SRAM (in 2 banks)
- 10/100 Ethernet MAC with external PHY interface
- USB Host/Device OTG controller and PHY. USB 2 full-speed
- I2S Digital Audio interface
- 3 I2C interfaces
- 2 SSP interfaces
- 1 SPI interface
- 2 CAN interfaces
- 8-channel, 12-bit on-chip ADC
- 10-bit on-chip DAC
- PWM generation
- Quadrature Encoder Interface
- 4 GP Timers
- Ultra low-power Real-Time-Clock
- Up to 70 GPIO pins

1.2 RDB1768V2 Evaluation Board Hardware

- Drag2FLASH feature makes board appear as mass storage device for simple binary file FLASHing
- LPC1768 running at 100MHz
- 128x128 pixel color LCD display driven by GPIO port pins
- Ethernet PHY – SMSC LAN8720
- USB Device interface with standard 'Mini-B' connector
- USB Host interface with standard 'A' connector
- On-board USB debug interface (no need for a debug probe)

- UDA1380 Stereo Audio codec connected to the LPC1768 I2S port with Headphone-out, Line-out, Line-in and Mic-in connectors. UDA1380 configuration uses I2C0. Rx and Tx I2S are decoupled so different sample rates can be used.

- Micro-SD card socket wired to SSP0/SPI port

- RS232 COM port interface on UART0 of LPC1768. Can be used to program LPC1768 FLASH in In-System Programming (ISP) mode

- Switching mini-Joystick with left, right, up, down and select outputs

- On board amplifier and speaker can be driven by UDA1380 codec and/or LPC1768 DAC

- Potentiometer connected to ADC input

- 12MHz Crystal for the main LPC1768 clock (simple multiple for USB)

- 25MHz Crystal for the Ethernet PHY

- On board regulators for 3v3 derived from Debug USB Mini-B, USB Device Mini-B or Power connector

- **All on-board peripherals can be disconnected by removable links on the board. All LPC1768 IO pins brought out to pin-thro pads for connection of external peripherals. For more information see section 4.**

2 COMPONENTS
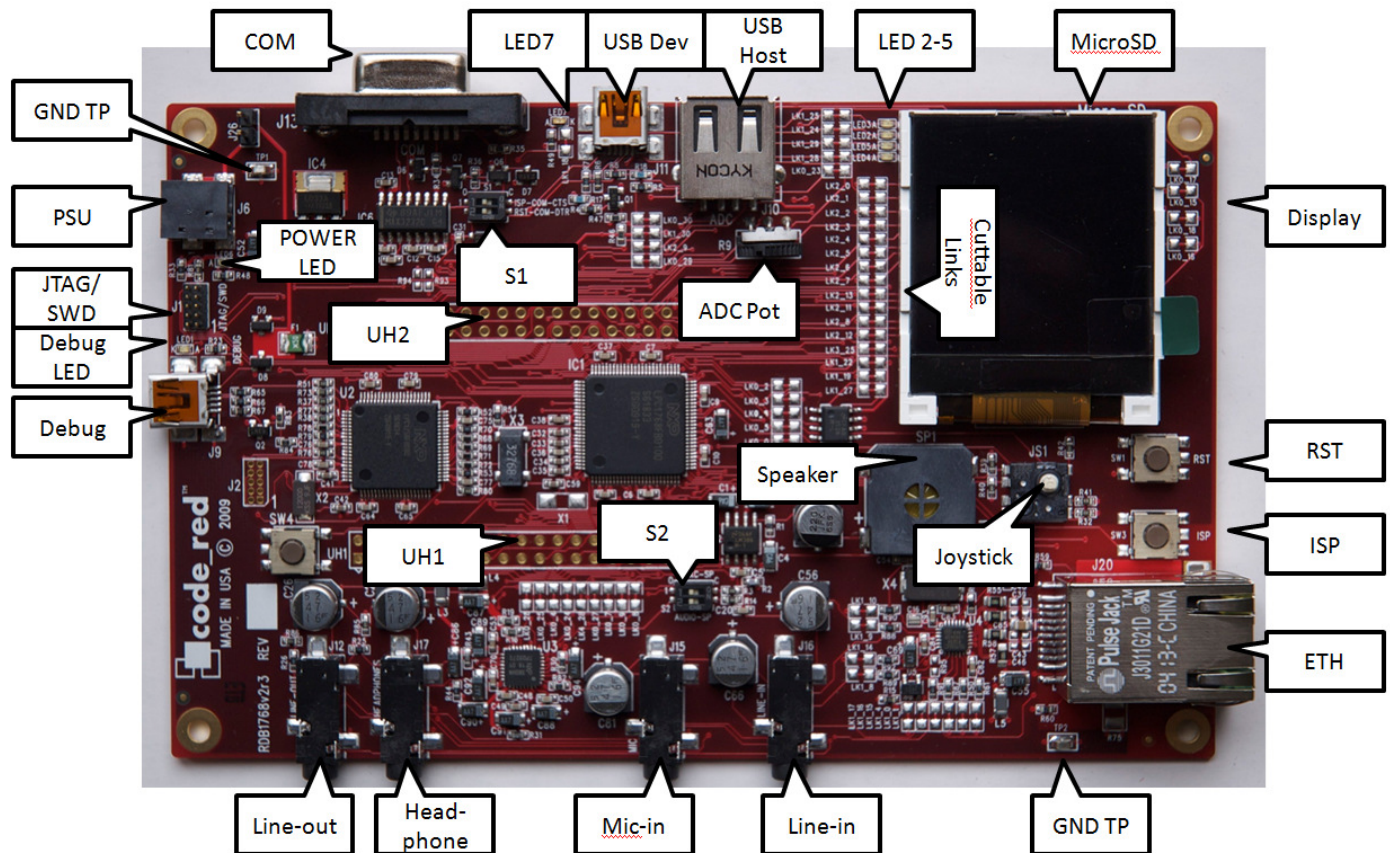
2.1 Component descriptions

NAME	DESCRIPTION
COM	RS232 COM port connected to UART0 on the LPC2368
S1	Dual DIP switch to allow configuration of ISP through the COM port
USB Dev	USB Device Mini-B connector. Can be used to power the board.
USB Host	USB Host 'A' connector. Can supply power to peripherals. Is limited to 500mA, but if board is being powered from one of it's USB device sockets then the capability will be less
LED1	LED1 indicates when an external debug probe is connected to the

NAME	DESCRIPTION
	JTAG/SWD connector
LED 2-5	User LEDS connected to P1_24, P1_25, P1_28, P1_29
NAME	**DESCRIPTION**
MicroSD	Micro-SD Card socket. Pins connect to SSI0/SPI on the LPC1768
Display	128x128 pixel color LCD display
RST	Reset button for processor
ISP	ISP button. Hold down with RST, then release RST first to enter ISP mode
ETH	The Ethernet connector
TP2	Scope probe GND post
Line-in	Stereo 3.5mm connector line level input connector to the audio codec
Mic-in	Sensitive mic input to the audio codec
S2	Dual DIP switch to select the source of audio to the speaker. Either the Codec, the DAC or a mix of both.
Headphone	Stereo 3.5mm connector for driving audio headphones
Line-out	Stereo 3.5mm line-level output from the audio codec
Debug	USB Mini-B connector for use of 'on-board' debug – direct connect to PC for debug with Red Suite. Can be used to power the board.
JTAG/SWD	Standard 0.05" pitch 2x5 pin JTAG/SWD connector for use of external debug probe such as Red Probe
PSU	External power supply connector – 5V D.C. regulated
TP1	Scope probe GND post
LED6	The power-on LED
LED7	USB device 'Goodlink' LED
UH1, UH2	User Headers with all IO pins
Speaker	Speaker driven from either on-chip DAC, or audio codec. Source is selected by S2.
Joystick	4-way + select, switch style joystick
ADC Pot	Potentiometer connected to Analogue to Digital Convertor (ADC) of LPC1768

3 HARDWARE

3.1 Schematics
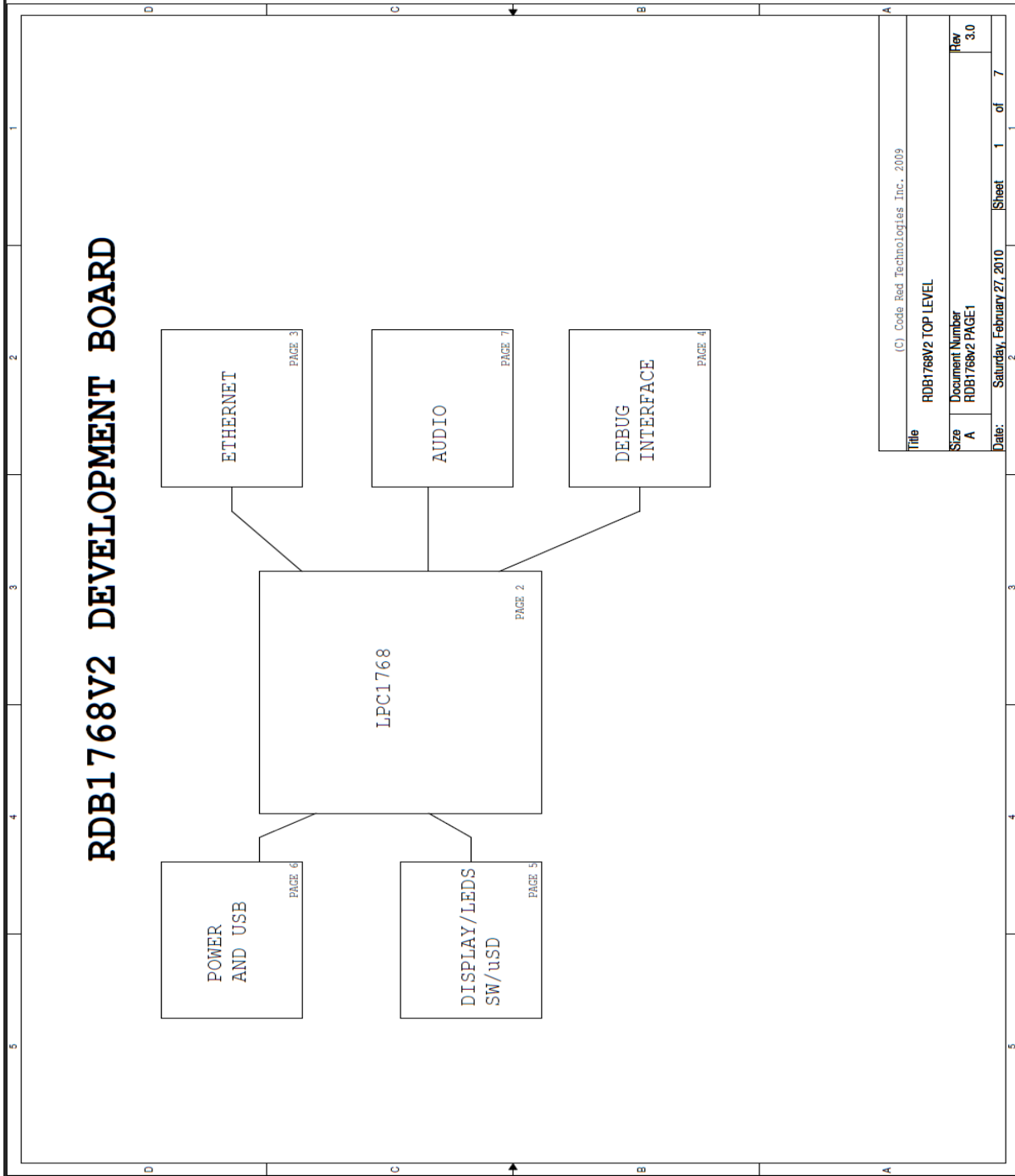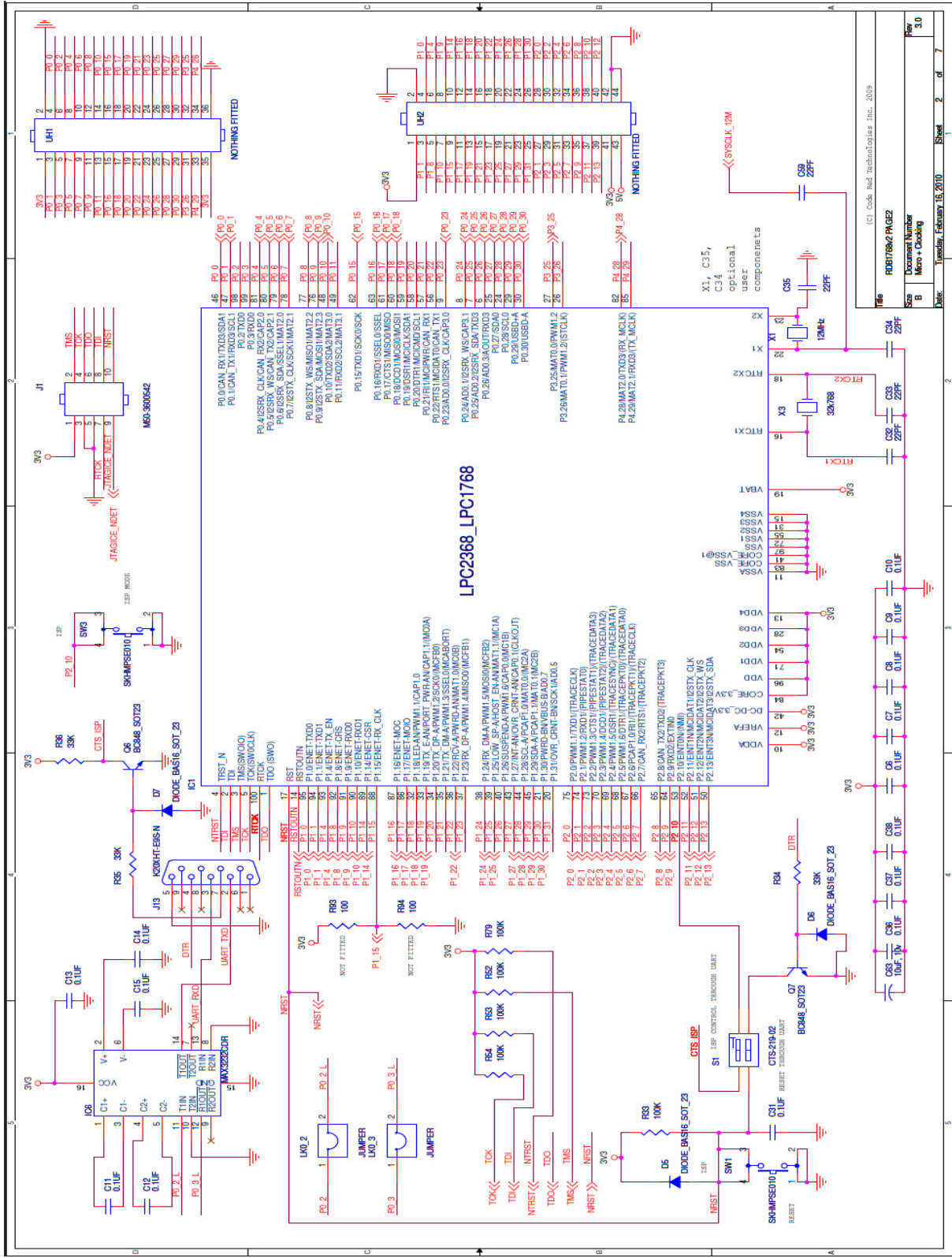
LPC2368_LPC1768

NOTHING FITTED

NOTHING FITTED

X1, C35, C34 optional user componenets

On Board Debug (OBD)

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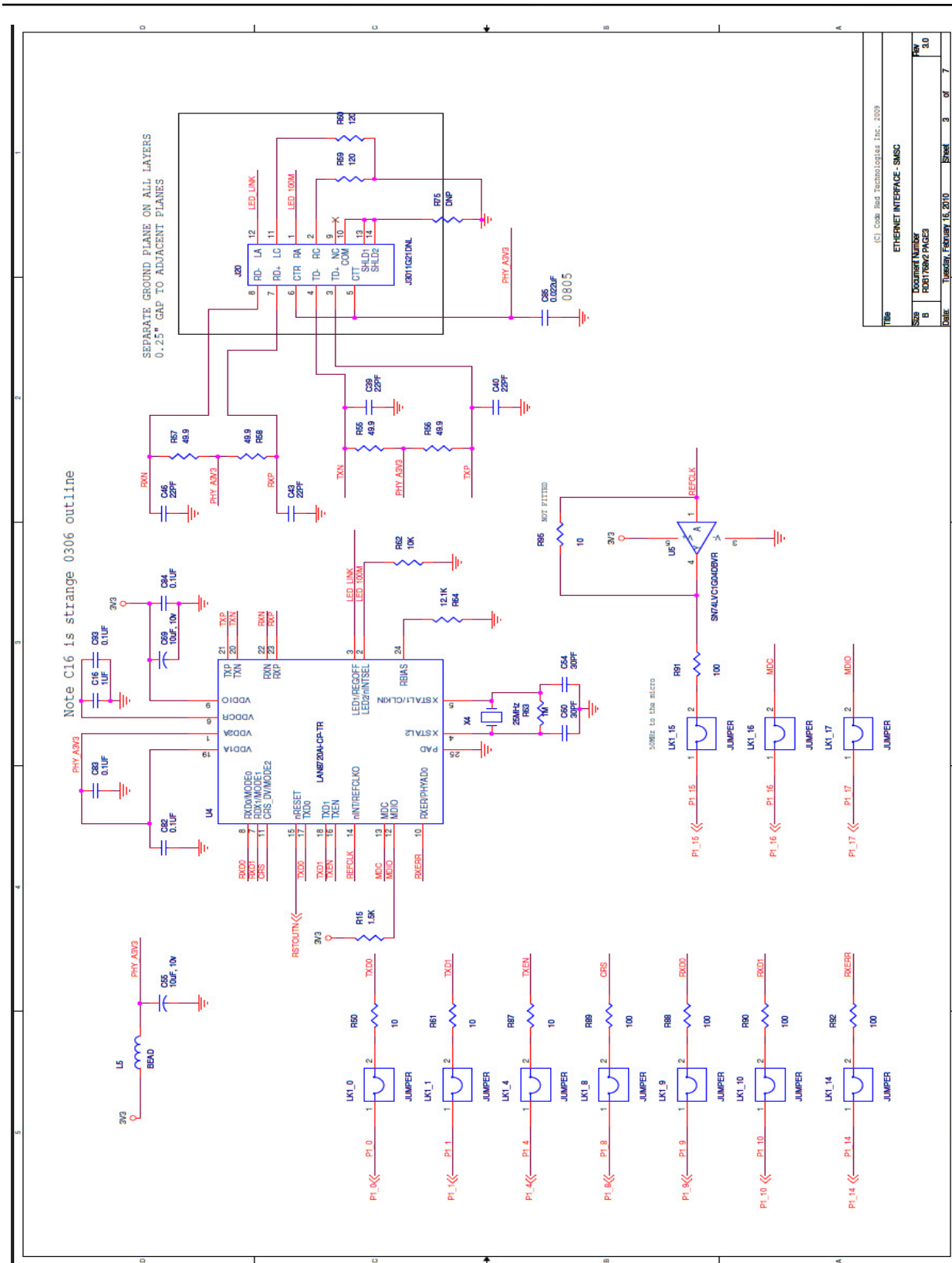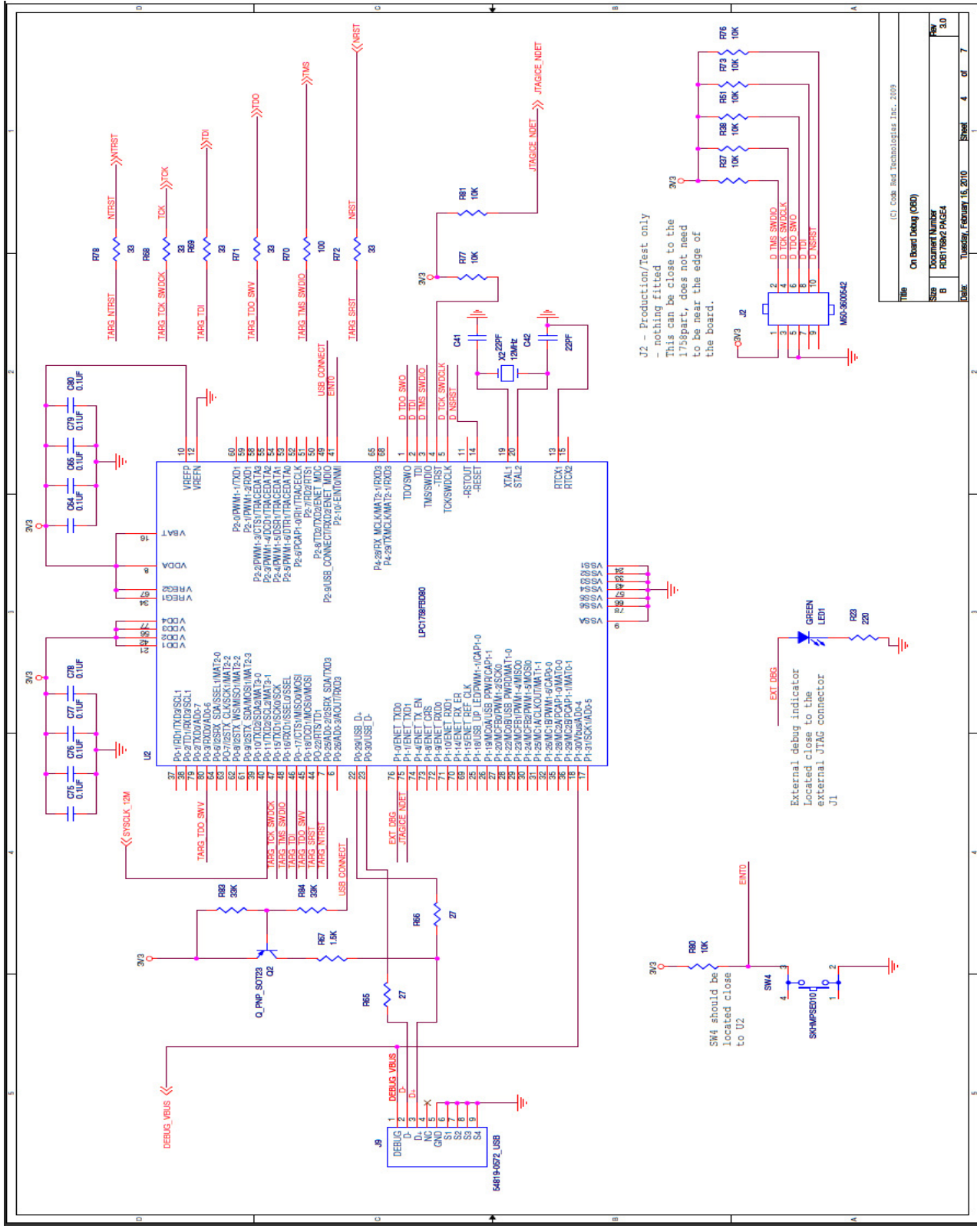
J2 - Production/Test only
- nothing fitted
This can be close to the
1768part, does not need
to be near the edge of
the board.
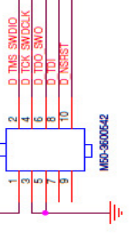
External debug indicator
Located close to the
external JTAG connector
J1

SW4 should be
located close
to U2

U2
LPC1768FBD80
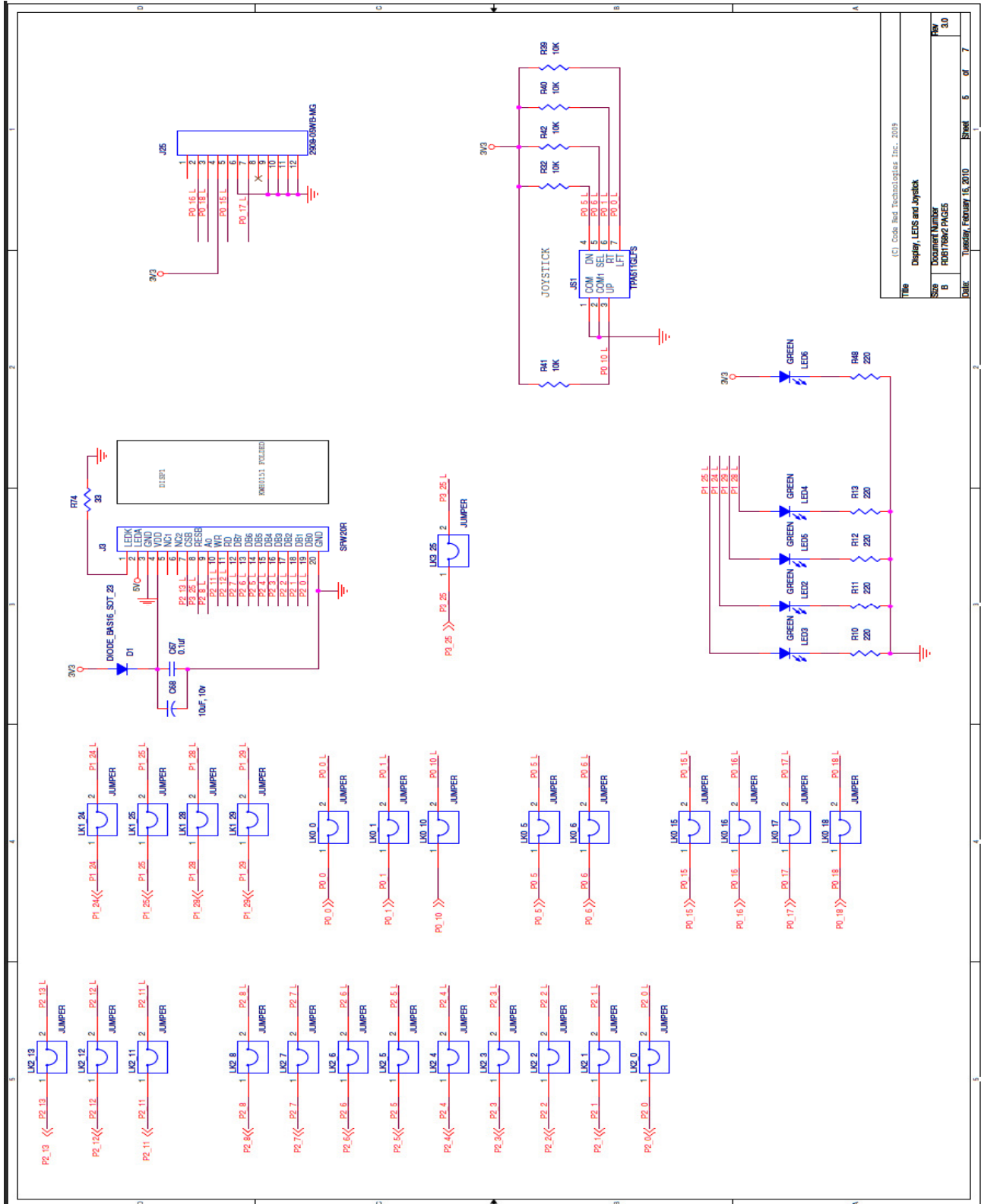
Display, LEDs and Joystick

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JOYSTICK — JS1 — TPA511GLFS

DISP1 — KMB01S1 POLISHED

R39 10K, R40 10K, R42 10K, R32 10K, R41 10K

R74 33, D1 DIODE_BAS16_SOT_23, C67 0.1uf, C68 10uF, 10v

LED6 GREEN R48 220, LED4 GREEN R13 220, LED5 GREEN R12 220, LED2 GREEN R11 220, LED3 GREEN R10 220

JUMPER — various LK jumpers: LK1 24, LK1 25, LK1 28, LK1 29, LK0 0, LK0 1, LK0 10, LK0 5, LK0 6, LK0 15, LK0 16, LK0 17, LK0 18, LK2 13, LK2 12, LK2 11, LK2 8, LK2 7, LK2 6, LK2 5, LK2 4, LK2 3, LK2 2, LK2 1, LK2 0

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Title
AUDIO

Size B
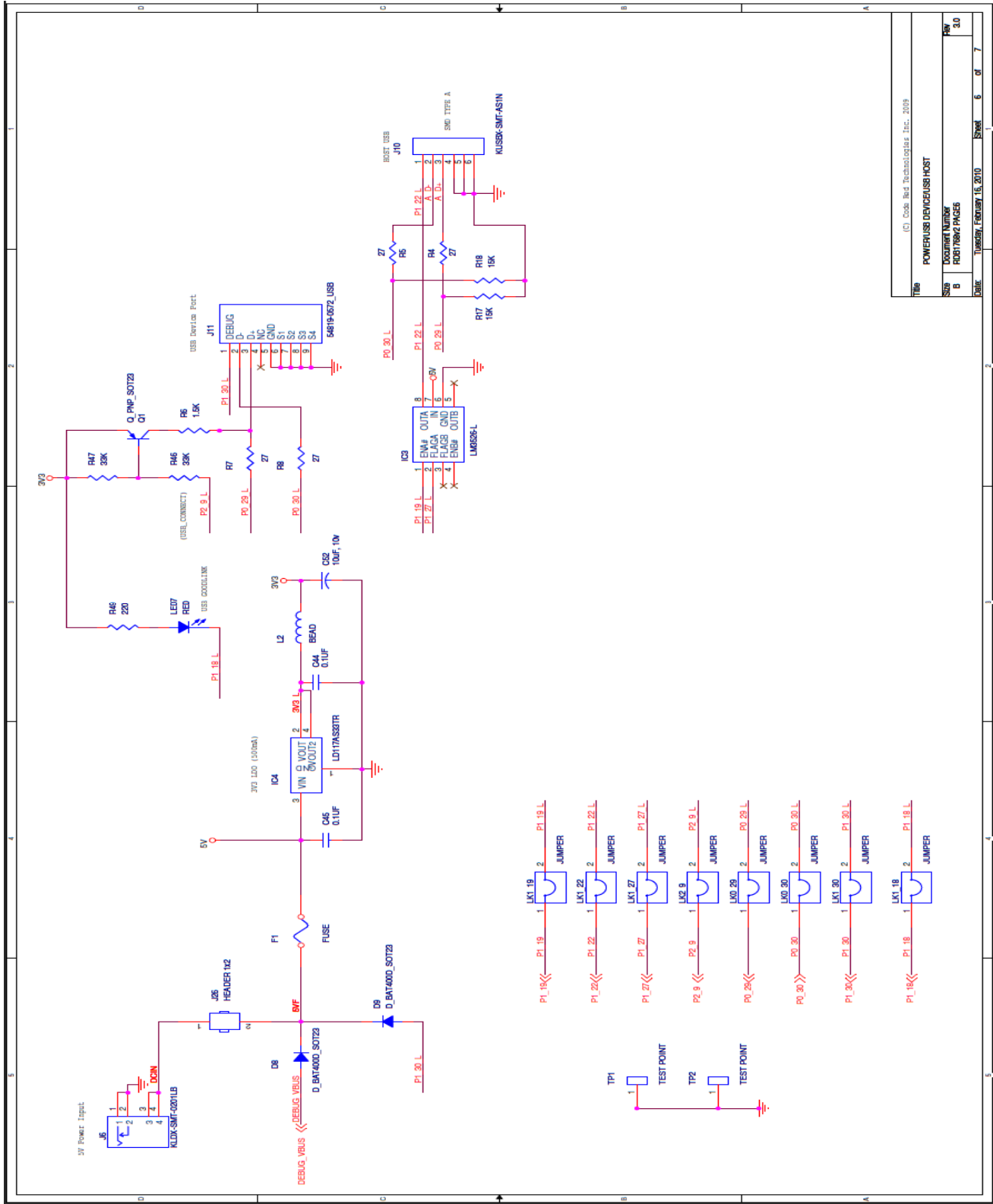
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J12 SJ3524-SMT LINE OUT
J17 SJ3524-SMT HEADPHONE OUT
J16 SJ3524-SMT LINE IN
J15 SJ3524-SMT MIC IN

ROUT
LOUT

R25 100
R26 100

R85 10K
R86 10K

C25 47UF 6.3V
C26 47UF 6.3V

C56 47UF 6.3V
C66 47UF 6.3V
C81 47UF 6.3V

LINENR
LINENL
MICIN

P0_23 L
JUMPER
LK0 23
P0 23
3V3
R9 20K
LPC1768 ADC
P0_23

UDA1380HN

VOUTL 23
VOUTR 21
VOUTLHP 19
VREFHP 18
VOUTRHP 17
VINL 27
VINR 29
VINM 31
VREF 25

VDDADA 22
VSSADA 24
VDDD 2
VSSD 10
VDDAAD 28
VSSAAD 26

VDDAHP
VSSAHP 16
VADDP 28
VADCN 30

RESET
SYSTCLK
DATAO
BCKO
WSO
BCKI
WSI
DATAI
L3CLK/SCL
L3MODE
L3DATA/SDA
SEL_L3_IIC
RTCB

CODEC_RESET
RX_MCK
I2SRX_CLK
I2SRX_WS
I2STX_CLK
I2STX_WS
I2STX_SDA

SCL
SDA
VDDD

C89 10uF, 10v
C93 0.1UF
C88 10uF, 10v
C90 0.1UF
R44 100
VDDA

C70 0.1uF, 10v
C92
R43 1
R80 10
VDDA
VDDD
R31 1
C49 0.1uF, 10v
C91
VDDA

C48 0.1UF
C90 10uF, 10v

C34 10uF, 10v
C87 10uF, 10v
C86 10uF, 10v
R82 33K
VDDA VDDD
3V3
L3 BLM31A601S
L4 BLM31A601S

R16 10K
R19 10K
SCL
SDA
VDDD

SMS-1508MS-R
SP1
Alternative speaker - pin thro
Uses P5 and P6
R45 0

C2 220UF 6.3V
R1 120
C4 1UF
C3 1UF
C1 1UF
LM386
IC2
1 GAIN
8 VOUT
5 BYP
6 VCC
4 GND
3 IN+
2 IN-
5V

R2 10K
C5 0.1UF
C20 0.1UF
R3 10K
R14 10K
S2 CTS-219-02
P0 26 ROUT
LPC1768 DAC
P0_26

I2STX_CLK
I2STX_WS
I2STX_SDA
SCL
SDA
RX_MCK
I2SRX_SDA
I2SRX_CLK
I2SRX_WS

JUMPER LK0 7 P0 7 P0_7
JUMPER LK0 8 P0 8 P0_8
JUMPER LK0 9 P0 9 P0_9
JUMPER LK0 28 P0 28 P0_28
JUMPER LK0 27 P0 27 P0_27
JUMPER LK4 28 P4 28 P4_28
JUMPER LK0 25 P0 25 P0_25
JUMPER LK0 4 P0 4 P0_4
JUMPER LK0 24 P0 24 P0_24

3.2 Mapping of peripherals to LPC1768 IO pins

Port	Bit	MODE	Usage	PERIPHERAL	COMMENTS
0	0	GPIO	joystick left	JOYSTICK	
0	1	GPIO	joystick right	JOYSTICK	
0	2	UART	UART_TXD	COM	
0	3	UART	UART_RXD	COM	
0	4	GPIO	joystick up	JOYSTICK	
0	5	GPIO	joystick down	JOYSTICK	
0	6	GPIO	joystick click	JOYSTICK	
0	7	I2S	I2STX_CLK	AUDIO	
0	8	I2S	I2STX_WS	AUDIO	
0	9	I2S	I2STX_SDA	AUDIO	
0	10	GPIO	CODEC_RESET	AUDIO	
0	15	SPI	sd_sck	SD	
0	16	SPI	sd_cs	SD	
0	17	SPI	sd_do	SD	
0	18	SPI	sd_di	SD	
0	23	ADC	POTENTIOMETER	POT	
0	25	I2S	I2SRX_SDA	AUDIO	
0	26	DAC	DACOUT	AUDIO	
0	27	I2C	SDA	AUDIO	
0	28	I2C	SCL	AUDIO	
0	29	USB	USB DEVICE D+	USB	
0	30	USB	USB DEVICE D-	USB	
1	0	ETH	txd_0	ETHERNET	
1	1	ETH	txd_1	ETHERNET	
1	4	ETH	tx_en	ETHERNET	
1	8	ETH	CRS	ETHERNET	
1	9	ETH	RXD_0	ETHERNET	
1	10	ETH	rxd_1	ETHERNET	
1	14	ETH	rx_er	ETHERNET	
1	16	ETH	mdc	ETHERNET	
1	17	ETH	mdio	ETHERNET	
1	18	USB	USB GOODLINK LED	USB	
1	19	USB	usb_port_pwr	USB	USB HOST POWER ENABLE
1	22	USB	usb_ppwrd#	USB	
1	24	GPIO	LED2 (USER)	LED	
1	25	GPIO	LED3 (USER)	LED	
1	27	USB	usb_ovrcr	USB	Overcurrent detect on the USB HOST
1	28	GPIO	LED4 (USER)	LED	
1	29	GPIO	LED5 (USER)	LED	
1	30	USB	USBDEV VBUS	USB	Detect VBUS
2	0	GPIO	db0	display	PIN 19 of ST7637 display controller
2	1	GPIO	db1	display	PIN 18 of ST7637 display controller
2	2	GPIO	db2	display	PIN 17 of ST7637 display controller
2	3	GPIO	db3	display	PIN 16 of ST7637 display controller

PORT	BIT	MODE	USAGE	PERIPHERAL	COMMENTS
2	4	GPIO	db4	display	PIN 15 of ST7637 display controller
2	5	GPIO	db5	display	PIN 14 of ST7637 display controller
2	6	GPIO	db6	display	PIN 13 of ST7637 display controller
2	7	GPIO	db7	display	PIN 12 of ST7637 display controller
2	8	GPIO	A0	display	PIN 9 of ST7637 display controller
2	9	USB	USB CONNECT	USB	
2	10		ISP BOOT	ISP BOOT	
2	11	GPIO	WR	display	PIN 10 of ST7637 display controller
2	12	GPIO	RD	display	PIN 11 of ST7637 display controller
2	13	GPIO	CSB (chip select)	display	PIN 7 of ST7637 display controller
3	25	GPIO	RESB (reset)	display	PIN 8 of ST7637 display controller
4	28	GPIO	TX_MCLK	AUDIO	

4 IO PADS FOR EXTERNAL CONNECTION

On the RDB1768, all of the peripherals on the board can be electrically isolated from the LPC1768 through the removal of links on the board. These are all labelled on the board. For example if the link labelled 'LK2_0' is removed, this will disconnect the display from IO pin P2_0. This will then allow the user to add any external peripheral using P2_0, connecting through the user headers UH1 and UH2.

The pinouts for user headers UH1 and UH2 can be seen on the schematics and below.

UH2 - User Header 2

GND	P1_0	P1_4	P1_9	P1_14	P1_16	P1_18	P1_20	P1_22	P1_24	P1_26	P1_28	P1_30	P2_0	P2_2	P2_4	P2_6	P2_8	P2_10	P2_12	GND	GND
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43
3.3V	P1_1	P1_8	P1_10	P1_15	P1_17	P1_19	P1_21	P1_23	P1_25	P1_27	P1_29	P1_31	P2_1	P2_3	P2_5	P2_7	P2_9	P2_11	P2_12	3.3V	5V

UH1 - User Header 1

GND	P0_0	P0_2	P0_4	P0_6	P0_8	P0_10	P0_15	P0_17	P0_19	P0_21	P0_23	P0_25	P0_27	P0_29	P3_25	P4_28	GND
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35
3.3V	P0_1	P0_3	P0_5	P0_7	P0_9	P0_11	P0_16	P0_18	P0_20	P0_22	P0_24	P0_26	P0_28	P0_30	P3_26	P4_29	3.3V

5 DEVELOPING AND DEBUGGING

The RDB1768 is designed to interface seamlessly with the Red Suite Development Environment from Code Red Technologies. Simply connecting a PC to the RDB1768 with the USB debug port enables Red Suite to be used as your code development and debugging environment.

The Drag2FLASH™ feature allows users to simply drag built binary files onto an Explorer window and press the button to FLASH the LPC1768 and start running the code.

The board also has a standard 10-pin 0.05" pitch JTAG/SWD connector. An external debug probe can be connected to this port for debugging. Red Probe from Code Red Technologies can be used with Red Suite 2 and connected directly to this connector. Alternatively, other debug probes and tool chains may be connected through this standard connector pin-out.

6 REFERENCES

1. CODE RED TECHNOLOGIES SUPPORT WIKI:
   www.code-red-tech.com/CodeRedWiki
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3. NXP LPC17xx DATA SHEETS:
   http://www.standardics.nxp.com/products/lpc1000/all/
4. ARM CORTEX-M3 TECHNICAL REFERENCE MANUAL:
   http://infocenter.arm.com/help/index.jsp?topic=/com.arm.doc.ddi0337g/index.html
5. FORMIKE KWH0151DN01-061A 128X128 COLOR DISPLAY SPECIFICATION
   Supplied as pdf.
6. SITRONIX ST7637 DISPLAY DRIVER DATA SHEET (AS USED ON ABOVE DISPLAY MODULE)
   Supplied as pdf.
7. National Semiconductor DP83848C PHYTER ETHERNET PHY DATASHEET:
   http://www.national.com/pf/DP/DP83848C.html
8. Cirrus Logic CS42L51 audio codec data sheet:
   http://www.cirrus.com/en/products/pro/detail/P1088.html