C1+

C1
0603
100nF

U1

C1- 4
C3
0603 C2+ 5
100nF C2- 6

+3.3v

C2
0603
100nF

GND

2	C1+	VCC	15
4	C1-	V+	3	V+
5	C2+		
6	C2-		

LPC_TXD   LPC TXD

LPC_RXD   LPC RXD   R1

1k

RXTTL

ByPass resistors for TTL

11   13   TX232

9   8   RX232

+3.3v

1   EN   INVALID   10
         FORCEON   12
         FORCEOFF 16
14 GND   V-   7   V-

Farnell: 9724508
MAX3221EEAE

C5
0603
100nF

+3.3v

C4
0603
100nF

GND

GND

GND

RS232

TX232
RX232
VBAT

| 4 |
| 3 |
| 2 |
| 1 |

rs232

GND

UART0 of the LPC can be used with 0 - 3.3V serial
lines and RS232 serial lines.

To use 0 - 3.3V use the GPS header and do not
connect the RS232 header. Remove R1.

To use -9 +9V RS232 serial lines use the RS232
header and do not connect the GPS header. Place
R1.

R1 can be 0R but 1k is prefered to protect in case a
device is plugged in GPS while R1 was still
mounted.

Title		
Size	Number	Revision
A4		
Date:	5-6-2011	Sheet of
File:	C:\Documents and Settings\..\rs232.SchDoc	Drawn By:

YetAnotherPaparazziAutopilot v2
by Christophe
(Februari 2011)
based on TWOG

ARM7

CTS405 12MHz
CTX639CT-ND
Q1
C12 18pF
C13 18pF
Xtal1 Xtal2

C10 100nF
C14 100nF
C6 100nF
C11 100nF
C15 100nF
+3.3v
GND

R4 1K
LED3
LED3
KP-1608SURC
754-1123-1-ND

U3
VBAT VREF VDDA VDD VDD VDD
49 63 7 23 43 51

P1.31/TRST
P1.30/TMS
P1.29/TCK
P1.28/TDI
P1.27/TDO
P1.26/RTCK
P1.25/EXTIN0
P1.24/TRACECLK
P1.23/PIPESTAT2
P1.22/PIPESTAT1
P1.21/PIPESTAT0
P1.20/TRACESYNC
P1.19/TRACEPKT3
P1.18/TRACEPKT2
P1.17/TRACEPKT1
P1.16/TRACEPKT0

P0.31/UP_LED/CONNECT
P0.30/AD0.3/EINT3/CAP0.0
P0.29/AD0.2/CAP0.3/MAT0.3
P0.28/AD0.1/CAP0.2/MAT0.2
P0.25/AD0.4/AOUT

P0.23/VBUS
P0.22/AD1.7/CAP0.0/MAT0.0
P0.21/PWM5/AD1.6/CAP1.3
P0.20/MAT1.3/SSEL1/EINT3
P0.19/MAT1.2/MOSI1/CAP1.2
P0.18/CAP1.3/MISO1/MAT1.3
P0.17/CAP1.2/SCK1/MAT1.2
P0.16/EINT0/MAT0.2/CAP0.2

P0.15/RI1/EINT2/AD1.5
P0.14/DCD1/EINT1/SDA1
P0.13/DTR1/MAT1.1/AD1.4
P0.12/DSR1/MAT1.0/AD1.3
P0.11/CTS1/CAP1.1/SCL1
P0.10/RTS1/CAP1.1/AD1.2
P0.9/RXD1/PWM6/EINT3
P0.8/TXD1/PWM4/AD1.1

P0.7/SSEL0/PWM2/EINT2
P0.6/MOSI0/CAP0.2/AD1.0
P0.5/MISO0/MAT0.1/AD0.7
P0.4/SCK0/CAP0.1/AD0.6
P0.3/SDA0/MAT0.0/EINT1
P0.2/SCL0/CAP0.0
P0.1/RXD0/PWM3/EINT0
P0.0/TXD0/PWM1

USB_CONNECT
ADC 4
ADC 5
ADC 6
IRH 2   ADC2

USB_VBUS_3V3
IRH 1   ADC1
IRV   ADC0
SSEL
MOSI
MISO
SCK
DRDY

VBAT_MEAS
BOOT
DTR
ADC 7
CTS
RTS
RXD1
TXD1

BUTTON
PPM_IN
SERV_CLK
ADC 3
SDA
SCL
LPC_RXD0
LPC_TXD0

R12 10K
R15 10K
R19 10K R20 10K
Pull low for ISP programming
Change to lower values for highspeed I2C (>100kHz)

LPC2148FBD64
568-1765-ND

R11 1K
LED2
KP-1608SURC
754-1123-1-ND
CAM_SW
GPS RESET
SERV_RST
PWR_SW
LED1
LED2

R16 1K
USB_P
USB_N
D+
D-

R22 10k
541-10.0KLCT-ND
LPC_RESET
C28 100nF
RESET
RXTC1
RXTC2
XTAL2
XTAL1
Xtal2 61
Xtal1 62

LED1
KP-1608SURC
754-1123-1-ND

Servos

C8 100nF   S9
+5V_BEC   Servo9   S9
R2 1k S9

C9 100nF   S4
+5V_BEC   Servo4   S4
R3 1k S4

C16 100nF   S8
+5V_BEC   Servo8   S8
R6 1k S8

C17 100nF   S5
+5V_BEC   Servo5   S5
R7 1k S5

C18 100nF   S1
+5V_BEC   Servo1   S1
R9 1k S1

C19 100nF   S3
+5V_BEC   Servo3   S3
R10 1k S3

C20 100nF   S7
+5V_BEC   Servo7   S7
R13 1k S7

C21 100nF   S6
+5V_BEC   Servo6   S6
R14 1k S6

C24 100nF   S2
+5V_BEC   Servo2   S2
CAM_SW 1k R17 CamSW
R35 1k Cam

C25 100nF   S0
+5V_BEC   Servo0   S0
R18 1k S0

4017

+5V_BEC C7 100nF
296-14252-ND
U2
VCC
CLK EN
RST
CLK
GND
TC
Q0 Servo0
Q1 Servo1
Q2 Servo2
Q3 Servo3
Q4 Servo4
Q5 Servo5
Q6 Servo6
Q7 Servo7
Q8 Servo8
Q9 Servo9

SERV_RST   S_Rst   R5 1k
SERV_CLK   S_Clk   R8 1k

4017

RC

C26 100nF
RC1
+5V_BEC   PPM_IN   RC
R21 1k   Header 3

GPS

J1
GPS_RESET
LPC_RXD0
LPC_TXD0
+3.3v
GPS

Bootloader

BOOT
Boot
GND
Boot

3.3V ARM Power

LT1963AEST-3.3#PBF-ND
U4
LT1963AEST-3.3
+5V   IN OUT +3.3v
GND TAB
C22 470nF
I4 4037
C23 33uF/6V
GND

3.3V Modem Power

In order to protect the processor with high power modems a separate supply is used
LT1963AEST-3.3#PBF-ND
U5
LT1963AEST-3.3 +3.3vModem
+5V   IN OUT
GND TAB
C27 470nF
I4 4037
C29 33uF/6V
GND

RS232

Uart0   rs232.SchDoc
LPC_RXD0   LPC_RXD
LPC_TXD0   LPC_TXD

Wireless

C30 0603 100nF
+3.3vModem
+3.3vModem XBee
XBee
Vcc   AD0/IO0
DOut   AD1/IO1
Din/Config   AD2/IO2
DO8   AD3/IO3
Reset   RTS
PWM0/RSSI   Associate
PWM1   AD-Vref
reserved   ON/Sleep
DTR   CTS/IO7
GND   AD4/IO4
XBee Comm Module
RXD1
TXD1
RSSI
ZrAc
ASSOC
ZcAr

LowPass RC or 5V Analog

ADC 6   A1
C31 100nF   R25 1k   +3.3v
GND   C43 100nF   +3.3v
P1   GND

ADC 5   A2
C32 100nF   R29 1k   +3.3v
GND
P2   GND

R25 / C31 and R29 / C32
1k / 100nF -> 1.5kHz lowpass
10k / 470nF -> 30Hz lowpass
0 Ohm / not mouted -> 3.3V
1.8k / 3.3k -> 5V
15k / 3.3k -> 18V
1.8k / 3.3k + 100nF -> 1.kHz lowpass 5V

5V Power

3 powering options are possible. Any power source plugged into the servo rail is called BEC. Any
power supply connected to the BAT header is called BAT.

a) (prefered) Servo's from BEC and autopilot from BAT: leave Switch Open
b) (ideal for testing) Everything from BAT: short the Switch (close)
c) Everything from BEC: unsolder the PTH08080 and short the Switch

Precautions:
a) make sure the BEC does not provide more than 8V (the RC ppm pulse should be reduced to less than 6V)
b) !!! make sure all the servo's together never ever use more than about 1 Amp: 2.25Amp - GPS
(0.3A) - XBee (0.4A) - LPC 0.3A or you will reset the autopilot !!!
c) make sure you use a high quality stable BEC

USB

USB_CONNECT   R23 1.5K   R24 10k   +3.3v
T1 BC807
568-1629-1-ND
USB_VBUS
R27 1.8k
R26 1.5k
USB_VBUS_3V3
USB_P   R28 33   USB+
541-33.0LCT-ND
USB_N   R31 33   USB-
R30 3.3k
C33 18pF   C34 18pF
GND

Modem

Modem +3.3vModem
CTS
RTS
RXD1
TXD1
Modem

IO
Digital
AUX   Aux
GND
Digital

Analog
ADC 4   Analog
IRH 2   ADC2
IRH 1   ADC1
IRV   ADC0
+3.3v
GND
Analog
C35 100nF
+3.3v
GND

SPI
SCK
DRDY
MISO
MOSI
SSEL
+3.3v
GND
Spi
SPI

I2C
SDA
SCL
GND
Digital
I2C

AUX Current

U6 TPS2051B
+5V_BEC
IN   OUT
EN   OC
GND
296-2265-1-ND
PWR_SW
AUX
C36 100nF
GND
C41 33uF/6V
399-4719-1-ND

BAT
SUPPLY
GND
VBAT
VBAT_MEAS
R32 10K
C38 100uF/20V
C42 100nF
R33 1.5K
541-1.50KLCT-ND

IC1
PTH_08080W
296-20432-ND
Vi   Vo
Inhibit
GND
VoAdj
C39 100nF
R34 330
541-330LCT-ND
+5V
C37 100nF
C40 100uF/20V
GND

+5V_BEC   +5V
Switch

Remote USB Header

USB
USB_VBUS
USB-
USB+
GND
Remote USB Header

USB2
1125348
Mini-Usb Connector
Vcc
Data-
Data+
Gnd
USB-
USB-
USB+
GND

Comment	Description	Designator	Footprint	LibRef	Quantity	Supplier 1	Supplier Part Number 1	farnell
1k		R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R13, R14, R16, R17, R18, R21, R25, R29, R35	0603RES	RES1	20			
1.5K		R23, R26, R33	0603RES	RES1	3	Digi-Key		
1.8k		R27	0603RES	RES1	1	Digi-Key		
3.3k		R30	0603RES	RES1	1	Digi-Key		
10K		R12, R15, R19, R20, R22, R24, R32	0603RES	RES1	7	Digi-Key	541-10.0KLCT-ND	
18pF		C12, C13, C33, C34	0603	CAP	4	Digi-Key	445-1238-1-ND	
33		R28, R31	0603RES	RES1	2	Digi-Key	541-33.0LCT-ND	
33uF/6V		C23, C29, C41	T491A	ELECTRO1	3	Digi-Key	399-4719-1-ND	
100nF		C6, C7, C8, C9, C10, C11, C14, C15, C16, C17, C18, C19, C20, C21, C24, C25, C26, C28, C31, C32, C35, C36, C37, C39, C42, C43	0603	CAP	26			
100uF/20V		C38, C40	T491D	ELECTRO1	2			
330		R34	0603RES	RES1	1	Digi-Key	541-330LCT-ND	
470nF		C22, C27	0805	CAP	2			1414037
0603	Capacitor	C1, C2, C3, C4, C5, C30	0603	Cap	6			
4017		U2	4017PW	4017	1	Digi-Key	296-14252-1-ND	
Analog	Header, 6-Pin	Analog	HDR6	Header 6	1			
BC807	PNP general purpose transistor (GRZ 10/2007)	T1	BC807	BC807	1	Digi-Key	568-1629-1-ND	
Cam	Header, 4-Pin	S2	HDR4	Header 4	1			
CTS405 12MHz	Crystal 12 Mhz SMD (DMT 06/2007)	Q1	CTS_405	CRYSTAL_CTS_405	1	Digi-Key	CTX639CT-ND	
Digital	Header, 2-Pin	Aux	HDR2	Header 2	1			
Digital	Header, 3-Pin	I2C	HDR3	Header 3	1			
GPS	Header, 5-Pin	J1	HDR5	Header 5	1			
Header 3	Header, 3-Pin	RC1	HDR3	Header 3	1			
KP-1608SURC	Led jaune 0603, Led rouge 0603 (GRZ 10/2007), Led vert 0603	LED1, LED2, LED3	KP-1608SURC	KP-1608SURC, KP-1608SURC_1	3	Digi-Key	754-1123-1-ND	
LPC2148FBD64	Single-chip ARM7 32-bit microcontroller (GRZ 04/2007)	U3	LPC2148FBD64	LPC2148FBD64	1	Digi-Key	568-1765-ND	
LT1963AEST-3.3	Régulateur 3.3v LDO (GRZ 09/2007)	U4, U5	LM3940IMP-3.3	LM3940IMP-3.3	2	Digi-Key	LT1963AEST-3.3#PBF-ND	
MAX3221EEAE	±15kV ESD-Protected 1µA, 3.0V/5.5V, 250kbps RS-232 Transceiver with AutoShutdown	U1	SSOP16	MAX3221EEAE	1			9724508
Mini-Usb Connector	Mini USB Connector	USB2	miniUSB	USB_Host	1			1125348
P1	Header, 3-Pin	ADC1	HDR3	Header 3	1			
P2	Header, 3-Pin	ADC1/2	HDR3	Header 3	1			
PTH_08080W		IC1	PTH_08080W	PTH_08080W	1	Digi-Key	296-20432-ND	
rs232	Header, 4-Pin	RS232	HDR4	Header 4	1			
S0	Header, 3-Pin	S0	HDR3	Header 3	1			
S1	Header, 3-Pin	S1	HDR3	Header 3	1			
S3	Header, 3-Pin	S3	HDR3	Header 3	1			
S4	Header, 3-Pin	S4	HDR3	Header 3	1			
S5	Header, 3-Pin	S5	HDR3	Header 3	1			
S6	Header, 3-Pin	S6	HDR3	Header 3	1			
S7	Header, 3-Pin	S7	HDR3	Header 3	1			
S8	Header, 3-Pin	S8	HDR3	Header 3	1			
S9	Header, 3-Pin	S9	HDR3	Header 3	1			
Spi	Header, 7-Pin	SPI	HDR7	Header 7	1			
SUPPLY	Header, 2-Pin	BAT, Switch	HDR1X2	Header 2	2			
TPS2051B	Current Limited Power Distribution Switch (GRZ 10/2007)	U6	TPS2051B	TPS2051B	1	Digi-Key	296-21265-1-ND	
XBee Comm Module	Header, 10-Pin, Dual	XBee	Xbee	Xbee	1			

Comment	Description	Designator	Footprint	LibRef	Quantity	Supplier 1	Supplier Part Number 1	farnell
1k		R2, R3, R5, R6, R7, R8, R9, R10, R11, R13, R14, R17, R18 R21, R25, R29, R35	0603RES	RES1	17			
1.5K		R23, R26, R33	0603RES	RES1	3	Digi-Key		
1.8k		R27	0603RES	RES1	1	Digi-Key		
3.3k		R30	0603RES	RES1	1	Digi-Key		
10K		R12, R15, R19, R20 R22, R24, R32	0603RES	RES1	7	Digi-Key	541-10.0KLCT-ND	
18pF		C12, C13, C33, C34	0603	CAP	4	Digi-Key	445-1238-1-ND	
33		R28, R31	0603RES	RES1	2	Digi-Key	541-33.0LCT-ND	
33uF/6V		C23	T491A	ELECTRO1	1			
100nF		C6, C7, C8, C10, C11, C14, C15, C16 C18, C20, C24, C26 C28, C35, C37, C39 C42, C43	0603	CAP	18			
100uF/20V		C38, C40	T491D	ELECTRO1	2			
330		R34	0603RES	RES1	1	Digi-Key	541-330LCT-ND	
470nF		C22	0805	CAP	1			1414037
0603	Capacitor	C30	0603	Cap	1			
4017		U2	4017PW	4017	1	Digi-Key	296-14252-1-ND	
BC807	PNP general purpos transistor (GRZ 10/2007)	T1	BC807	BC807	1	Digi-Key	568-1629-1-ND	
CTS405 12MHz	Crystal 12 Mhz SMD (DMT 06/2007)	Q1	CTS_405	CRYSTAL_CTS_405	1	Digi-Key	CTX639CT-ND	
KP-1608SURC	Led jaune 0603	LED2	KP-1608SURC	KP-1608SURC_1	1	Digi-Key	754-1123-1-ND	
LPC2148FBD64	Single-chip ARM7 3 bit microcontroller (GRZ 04/2007)	U3	LPC2148FBD64	LPC2148FBD64	1	Digi-Key	568-1765-ND	
LT1963AEST-3.3	Régulateur3.3v LDO (GRZ 09/2007)	U4	LM3940IMP-3.3	LM3940IMP-3.3	1	Digi-Key	LT1963AEST-3.3#PBF-ND	
PTH_08080W		IC1	PTH_08080W	PTH_08080W	1	Digi-Key	296-20432-ND	

Comment	Description	Designator	Footprint	LibRef	Quantity	Supplier 1	Supplier Part Number 1	farnell
1k		R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R13, R14, R16, R17, R18, R21, R25, R29, R35	0603RES	RES1	19			
1.5K		R23, R26, R33	0603RES	RES1	3	Digi-Key		
1.8k		R27	0603RES	RES1	1	Digi-Key		
3.3k		R30	0603RES	RES1	1	Digi-Key		
10K		R12, R15, R19, R20, R22, R24, R32	0603RES	RES1	7	Digi-Key	541-10.0KLCT-ND	
18pF		C12, C13, C33, C34	0603	CAP	4	Digi-Key	445-1238-1-ND	
33		R28, R31	0603RES	RES1	2	Digi-Key	541-33.0LCT-ND	
33uF/6V		C23, C29, C41	T491A	ELECTRO1	3	Digi-Key	399-4719-1-ND	
100nF		C6, C7, C8, C9, C10, C11, C14, C15, C16, C17, C18, C19, C20, C21, C24, C25, C26, C28, C31, C32, C35, C36, C37, C39, C42, C43	0603	CAP	26			
100uF/20V		C38, C40	T491D	ELECTRO1	2			
330		R34	0603RES	RES1	1	Digi-Key	541-330LCT-ND	
470nF		C22, C27	0805	CAP	2			1414037
0603	Capacitor	C30	0603	Cap	1			
4017		U2	4017PW	4017	1	Digi-Key	296-14252-1-ND	
Analog	Header, 6-Pin	Analog	HDR6	Header 6	1			
BC807	PNP general purpos transistor (GRZ 10/2007)	T1	BC807	BC807	1	Digi-Key	568-1629-1-ND	
Cam	Header, 4-Pin	S2	HDR4	Header 4	1			
CTS405 12MHz	Crystal 12 Mhz SMD (DMT 06/2007)	Q1	CTS_405	CRYSTAL_CTS_405	1	Digi-Key	CTX639CT-ND	
Digital	Header, 2-Pin	Aux	HDR2	Header 2	1			
Digital	Header, 3-Pin	I2C	HDR3	Header 3	1			
GPS	Header, 5-Pin	J1	HDR5	Header 5	1			
Header 3	Header, 3-Pin	RC1	HDR3	Header 3	1			
KP-1608SURC	Led jaune 0603, Led rouge 0603 (GRZ 10/2007), Led vert 0603	LED1, LED2, LED3	KP-1608SURC	KP-1608SURC, KP-1608SURC_1	3	Digi-Key	754-1123-1-ND	
LPC2148FBD64	Single-chip ARM7 3 bit microcontroller (GRZ 04/2007)	U3	LPC2148FBD64	LPC2148FBD64	1	Digi-Key	568-1765-ND	
LT1963AEST-3.3	Régulateur 3.3v LDO (GRZ 09/2007)	U4, U5	LM3940IMP-3.3	LM3940IMP-3.3	2	Digi-Key	LT1963AEST-3.3#PBF-ND	
Mini-Usb Connector	Mini USB Connector	USB2	miniUSB	USB_Host	1			1125348
P1	Header, 3-Pin	ADC1	HDR3	Header 3	1			
P2	Header, 3-Pin	ADC1/2	HDR3	Header 3	1			
PTH_08080W		IC1	PTH_08080W	PTH_08080W	1	Digi-Key	296-20432-ND	
S0	Header, 3-Pin	S0	HDR3	Header 3	1			
S1	Header, 3-Pin	S1	HDR3	Header 3	1			
S3	Header, 3-Pin	S3	HDR3	Header 3	1			
S4	Header, 3-Pin	S4	HDR3	Header 3	1			
S5	Header, 3-Pin	S5	HDR3	Header 3	1			
S6	Header, 3-Pin	S6	HDR3	Header 3	1			
S7	Header, 3-Pin	S7	HDR3	Header 3	1			
S8	Header, 3-Pin	S8	HDR3	Header 3	1			
S9	Header, 3-Pin	S9	HDR3	Header 3	1			
Spi	Header, 7-Pin	SPI	HDR7	Header 7	1			
SUPPLY	Header, 2-Pin	BAT, Switch	HDR1X2	Header 2	2			
TPS2051B	Current Limited Power Distribution Switch (GRZ 10/2007)	U6	TPS2051B	TPS2051B	1	Digi-Key	296-21265-1-ND	
XBee Comm Module	Header, 10-Pin, Dua	XBee	Xbee	Xbee	1			