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Propeller QuickStart (#40000)

The Propeller QuickStart is a simple and accessible development platform for the P8X32A Propeller microcontroller. The built-in buffered USB to serial converter and bus-powered design allow easy programming with a single cable. The eight buffered LEDs and resistive touch buttons provide a simple interface without loading I/O pins. All Propeller I/O pins are accessible through either a socket or solderable connections.

The 2" by 3" Propeller QuickStart requires minimal space on the workbench or at a computer desk and is excellent for projects on the go.

As an open-source hardware design, all design files—including layout, schematics, and firmware—are available under licenses that allow free distribution and reuse. This means that the Propeller QuickStart's design can be incorporated into new applications royalty free and without a non-disclosure agreement.

Features

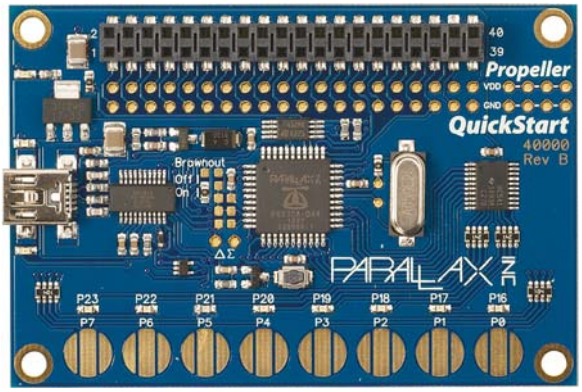
- Propeller P8X32A microcontroller
- Eight resistive touch buttons
- Eight buffered LEDs
- Buffered USB to serial converter with USB bus power
- Rev B supports power from USB chargers
- All 32 I/O pins available through an accessory socket

Key Specifications

- Power Requirements: 3.3 or 4 to 9 VDC, 15 mA minimum, 500 mA recommended
- Communication: USB, 3.3 V serial, I2C
- Operating temperature: -40 to +185 °F (-40 to +85 °C)
- Dimensions: 2.0 x 3.0 x 0.36 in (5.0 x 7.6 x 0.84 cm) mounting hole centers separated by 2.75 x 1.75 in (59.85 x 44.45 mm)

Application Ideas

- Reference design
- Development platform
- Embedded processor board



Synopsis

The QuickStart is designed as a small, inexpensive, accessible, and easy to use development platform for the Propeller microcontroller. The QuickStart is designed to provide interfaces to a computer and to a user, through a USB port, LEDs, and touch sensitive buttons, while dedicating as few I/O pins as possible to a specific task. All of the Propeller's 32 I/O pins are available through the accessory socket and through solderable through-hole vias. The USB to serial converter, when powered, uses two of the I/O pins.

Two I/O pins connect to a USB to serial converter, and two connect, through an I2C bus, to a 64 KB EEPROM. Eight of the I/O drive LEDs through a buffer, to prevent the LEDs from loading the I/O pins. Eight more I/O pins connect to resistive touch buttons that also do not load the I/O pins when not in use. The 12 remaining I/O pins connect only to the accessory connections.

The 40-pin accessory socket and the nearby plated-through vias, provide access to several power pins, USB control signals, reset, a clock input pin, and all 32 Propeller I/O pins, including the serial and I2C pins used during startup.

Open-source hardware

The QuickStart is an open-source hardware design that is well suited for use as a reference design, built into a custom product, or used as a stand-alone board containing a custom firmware application. All design files are available under various open-source licenses, as included with each file.

Getting started

To program the QuickStart board, install and run the Propeller Tool, available from www.parallax.com/propellertool, and connect connect it to a computer using a USB A to mini B Cable, such as part number 805-00006, available from parallax.com. See the QuickStart product page for a selection of examples using the Propeller QuickStart board as well as design files including schematics and layout.

Parallax P8X32A Propeller Microcontroller

The Propeller microcontroller, U1, is an 8-core, low-power microcontroller with 32 KB SRAM and up to 20 MIPS per core. By partitioning separate tasks into separate cores, the Propeller can load programs and features and reallocate resources on the fly, without the overhead of an operating system. Features that often require dedicated hardware can be defined in software and run in parallel. When running at a total of 160 MIPS, the power consumption is usually less than 80 mA. For more information, refer to the Parallax P8X32A Propeller datasheet.

USB port

On Rev A boards, the USB mini B port, J2, connects to an FTDI FT232RL USB to serial converter, U3. The I/O pins from U3 are buffered through U4. The TXD pin from U3 connects to RX, or P31, on the Propeller. The RXD pin from U3 connects to TX, or P30, on the Propeller. The USB circuitry, including U3 and U4, is powered from the USB bus, so when there is no USB connection present, the unpowered buffer's inputs float, leaving P30 available for other uses.

On Rev B boards, the USB mini B port, J2, connects to an FTDI FT231XS USB to serial converter, U3. The TXD pin on U3 connects to RX, or P31, on the Propeller, through U6. The RXD pin from U3 connects directly to TX, or P30 on the Propeller. When there is no USB connection present, the buffer's output and FT231XS inputs and outputs float, leaving P30 and P31 available for other uses, included programming the Propeller from an external device.

Power LED

The power LED, D11, will light green with sufficient power on V_{DD}. It may also light or partially light with insufficient power on V_{DD}.

LEDs

D1—D8 indicate the status of P0—P7, respectively. The LEDs are driven through a buffer, so they do not load the I/O pins. If the P0 through P7 are left floating, the LEDs may light when the respective I/O pin floats high. To ensure that they stay off when the I/O pin is not in use, drive the I/O pin low.

Resistive Touch Buttons

P0 through P7 are connected to resistive touch buttons. Each button is a pad, surrounded by ground pads, connected through a 100 K ohm ESD protection resistor, to the I/O pin. When the buttons are not in use, they will not load the I/O pins. When touched, they will add negligible resistive loading. To read the state of the button, set the I/O pin as a high output, then immediately switch it to an input, then measure the amount of time before the I/O pin falls low. If nothing is touching the pad, the parasitic capacitance of the I/O pin and the PCB will hold the input high for several milliseconds. Alternately, instead of measuring the fall time, measure the input state I millisecond after the pin was switched to an input. See the "Touch Buttons LED Demo" available from the QuickStart product page at www.parallax.com.

Serial EEPROM

The 64 KB EEPROM, U2, is connected to the I2C bus on P27 and P28. The lower 32 KB contain the program that the Propeller loads on reset. The upper 32 KB can be used for non-volatile data storage. For more information, refer to the AT24C512 datasheet.

Crystal

The QuickStart includes a 5 MHz crystal, for use when running at either 5 MHz without the use of a PLL, or 5, 10, 20, 40, or 80 MHz when used with the internal PLL. The Propeller can also run at nominal 20 kHz or 12 MHz using internal RC time constants. The 5 MHz crystal is connected through a surface-mount shunt, R13, which can be removed to disconnect the crystal. For custom crystal frequencies, remove the shunt and add another crystal to the unpopulated crystal socket, X2. The Propeller can also be driven through the XI line on the accessory connections, with or without the shunt present.

Brownout Detector

The Propeller's built in brownout voltage detector is enabled, by default, through a surface mount shunt, R12. For operation at or lower than 3.0 VDC V_{DD}, move R12 from the position marked "On" on the PCB to the position marked "Off". To ensure stability, use an external brownout voltage detector rated for 2.7 VDC or higher.

Reset Button

The reset button, when pressed, will force the Propeller to reset which will cause it to reload any code present in the EEPROM.

Delta Sigma (ΔΣ) digital to analog conversion

The unpopulated R14, R15, C16, and C17 pads are available for experimenting with Delta Sigma modulation. R15 is the input resistor, R14 is the feedback resistor, and C16 and C17, in parallel, act as the capacitor. The plated-through just below R15 is the input, and the plated-through just below R14 is ground.

Power Isolation

Rev B boards include a zero-ohm resistor, R16, that connects the Propeller microcontroller to the 3.3 VDC regulator. The LED, the Serial EEPROM, U2, and pin 38 on the Accessory Socket are are connected directly to the 3.3 VDC regulator. The Propeller microcontroller, the USB input buffer, U6, and pin 38 on the solder connection alongside the Accessory Socket are connected through the zero-ohm resistor. For applications that require running the Propeller microcontroller at a voltage other than 3.3 VDC regulator or those that require measurement of the Propeller microcontroller's power consumption, remove R16 and power the Propeller microcontroller through pin 38 on the solder connection.

Accessory Socket

The 40-pin Accessory Socket (J1) includes connections for power, USB signals, and all Propeller I/O pins, included those used in the I2C bus and those used for USB communications, as shown in the tables below. Rev B boards allow connections to the Accessory Socket through the top or bottom of the socket. The pin connections are labeled on the bottom side of Rev B boards.

There is also a set of 40 solder points alongside the Accessory Socket that mirror the connections on the Accessory Socket. Rev B boards have the 3.3 V connection on the Accessory Socket connected directly to the 3.3 VDC regulator but the 3.3 V connection on the solder points connected directly to the Propeller microcontroller. The two connections are connected through R16, a zero-ohm resistor. For information about separating the two, see Power Isolation above.

Pin	Connections	Functions
1	P0	I/O Pin
3	P2	I/O Pin
5	P4	I/O Pin
7	P6	I/O Pin
9	P8	I/O Pin
11	P10	I/O Pin
13	P12	I/O Pin
15	P14	I/O Pin
17	P16	I/O Pin
19	P18	I/O Pin
21	P20	I/O Pin
23	P22	I/O Pin
25	P24	I/O Pin
27	P26	I/O Pin
29	SDA P29	I2C Serial Data I/O Pin
31	SCL P28	I2C Serial Clock I/O Pin
33	TX P30	Propeller Transmit Pin at Start Up I/O Pin
35	RX P31	Propeller Receive Pin at Start Up I/O Pin
37	RESn	Propeller Reset Pin
39	V_{SS}	Ground

Pin	Connections	Functions
2	P1	I/O Pin
4	P3	I/O Pin
6	P5	I/O Pin
8	P7	I/O Pin
10	P9	I/O Pin
12	P11	I/O Pin
14	P13	I/O Pin
16	P15	I/O Pin
18	P17	I/O Pin
20	P19	I/O Pin
22	P21	I/O Pin
24	P23	I/O Pin
26	P25	I/O Pin
28	P27	I/O Pin
30	/USB_PWR_EN (Labeled /UPE)	Allow Power Sourcing from the USB Port
32	XI	Propeller Clock Input Pin for External Driving
34	/RTS	Inverted RTS Signal from USB to Serial Converter
36	/CTS	Inverted CTS Signal from USB to Serial Converter
38	V_{DD}	Regulated 3.3 VDC Input
40	V_{IN}	Unregulated 4 to 9 VDC Input

Pin Functions

- P0 through P7 — General purpose input/output pins. Also connected to the resistive touch buttons. When not in use, the buttons will not load the I/O pins, when touched, they will add negligible resistive loading.
- P8 through P15 — General purpose input/output pins.
- P16 through P23 — General purpose input/output pins. Signals are buffered and displayed on D1 through D8, with the most-significant bit on the left.
- P24 through P27 — General purpose input/output pins.
- P28, SCL — I2C serial clock pin. Pulled to V_{DD}. Connected to the built-in EEPROM. Can be connected to external I2C devices.
- P29, SDA — I2C serial data pin. Pulled to V_{DD}. Connected to the built-in EEPROM. Can be connected to external I2C devices.
- P30, TX — Propeller transmit at startup. General purpose input/output pin after startup. Connected to the USB to serial converter receive pin.
- P31, RX — Propeller receive at startup. General purpose input/output pin after startup Connected to the USB to serial converter transmit pin. Do not drive when the USB circuitry is powered.
- RESn — Propeller reset pin, inverted. Pulled to V_{DD}. Driven low on internal reset. Drive low to externally reset the Propeller.
- /USB_PWR_EN — USB power enable pin, inverted. Pulled to USB 5 V supply. Internally pulled low after successful USB power negotiation. Drive low to force the USB power input to drive the QuickStart power supply. Drive high with 6 VDC to disable power sourcing from the USB connector. Rev B and later boards also internally pull low /USB_PWR_EN low upon detecting a USB charger. Rev A boards must have /USB_PWR_EN externally driven low to power from a USB charger.
- XI — Propeller clock input. Do not load when not in use. Can drive the Propeller clock from an external signal, using the XINPUT directive.
- /RTS — USB to serial converter Request To Send output, inverted.
- /CTS — USB to serial converter Clear To Send input, inverted.
- V_{DD} — Propeller power supply. Drive with 2.7 to 3.6 volts. Internally driven to a nominal 3.3 volts with sufficient voltage on the V_{IN} pin, or from the USB bus when /USB_PWR_EN is low.
- V_{IN} — Voltage regulator input. Drive with 4 to 9 volts. Internally driven to a nominal 5 volts, from the USB bus when /USB_PWR_EN is low.
- V_{SS} — Ground

Specifications

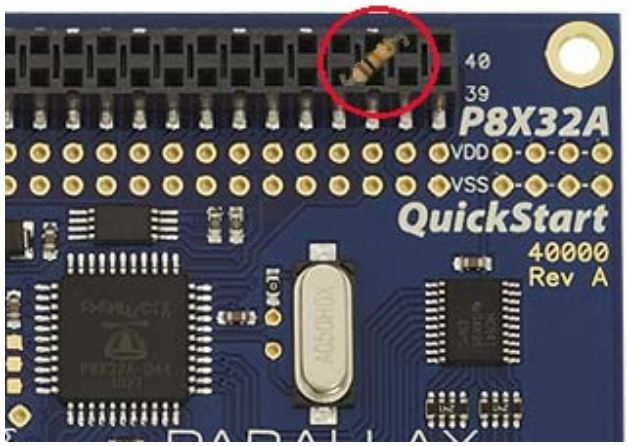
Symbol	Parameter	Minimum	Typical	Maximum	Units
V_{IN}	Supply Voltage input on J1 pin 40	4.0		9.0	V
V_{DD}	Supply Voltage input on J1 pin 38	3.0		3.6	V
I_{IN}	Rev A running at 80 MHz with all cogs sleeping		11		mA
I_{IN}	Rev B running at 80 MHz with all cogs sleeping		9.8		

Absolute Maximum Ratings

Symbol	Parameter	Minimum	Maximum	Units
V_{IN}	Supply Voltage on J1 pin 40	-0.3	18	V
V_{DD}	Supply Voltage on J1 pin 38	-0.3	4	V

Using Rev A with SimpleIDE

"Error: load fail" messages are occasionally seen when using the QuickStart Rev A with the SimpleIDE programming software. To remedy this, insert a 10 k-ohm pull-up resistor into the Accessory Socket as shown below. This is not necessary with QuickStart Rev B boards.



Revision History

Version 1.0: Original release

Version 1.1: Added documentation for Rev B

Version 1.2: Corrected power isolation pin references and mounting-hole dimensions

Version 1.3: Added Using Rev A with SimpleIDE note, above.