MNML•PIC•18: A PIC18F4520 Not-quite Minimal System

The circuit board packages a Microchip PIC18F4520 microcontroller with a power supply, clock, ICSP/ICSD port and an RS-232 driver. The board is a surface-mount revision of the MNML•PIC•18 board, with a PIC18F4520 rather than a PIC18F452. It is designed to be used in the MTRX3700 Major Project. This document provides only a brief overview of the circuit design and layout.

1 Circuit Schematic

A schematic of the circuit is shown as Figure 2, and consists of three sub-circuits: power supply, clock and I/O.

1.1 Power Supply

Power supply to the PIC18F4520 is specified as 2.0 V to 5.5 V, with a maximum operating current of 7 mA (5V, 10MHz. This supply is provided by a U1, an Intersil LT1521CST-5 low dropout linear regulator in a 3-pin SOT223 package, together with input and output capacitors C1 and C2. The regulator is rated at 300 mA output. Power supply at the input to this regulator can be any DC voltage between 5.5 V and 20.0 V so that the board may be supplied either by the Lab plug packs via X1A, or by a 9V alkaline battery via X1B. Regulated 5.0 V DC power can also be supplied at via the 2-pin connectors X2 or X9.

1.2 Clock

The PIC18F4520 processor is provided with an Abracon ABM3 10 MHz parallel-resonant crystal Y1, and starting capacitors C6 and C7. A near-sinusoidal signal of 10 MHz frequency and about 2.5V peak-to-peak amplitude should be present on the crystal. The PIC18F4520 can also be clocked at up to 8 MHz by its internal oscillator.

1.3 Serial Port

RS-232 serial port levels are created by U3, an Intersil HIN232ECP RS-232 driver. This IC is 5V powered, and uses charge pumps to generate ±10V internally. The IC translates TTL levels to differential 10V levels. Power consumption is 5mA. It is static protected to 15kV.

1.4 ICSP/ICSD Port

Connector X11 is the Microchip standard in-circuit serial programming/debugging connector.

1.5 LED

A red LED (diode D4) is provided for user convenience on PortB.4.

2 Printed Circuit Board

The circuit board is a double-sided two-layer board with plated-through holes, containing a mixture of surface-mount and through-hole components. Most tracks are 15 mil (0.38 mm), with 10 mil (0.25 mm) clearance. Vias (through-board connections) are 1.0 mm, 0.60 mm holes. Several +0V and +5V test points are provided.

Pin 1 of all components is signified by a square pad – this is an industry convention. In addition, pin 1 of each polarised components is marked by a small dot, and pin 1 of each

connector is marked by a small triangle on the silkscreen layer. The PCB component overlay is shown in Figure 1.

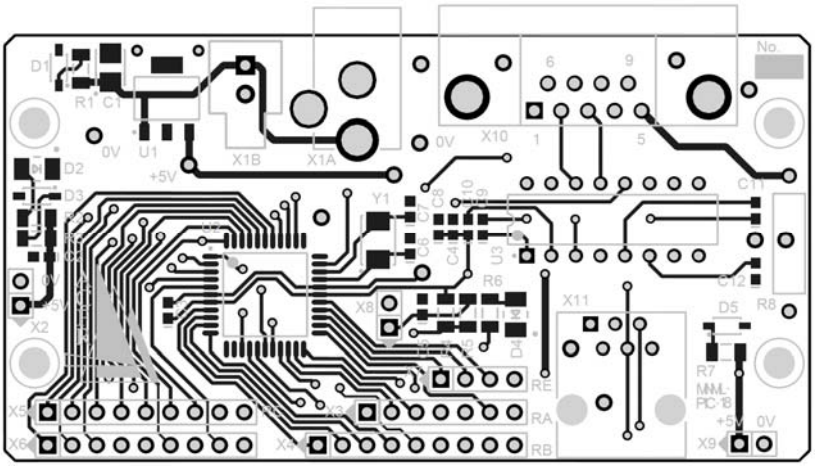

Figure 1: Circuit Board component overlay, top side.

2.1 Processor and Oscillator

The 10.000 MHz crystal Y1 is placed close to the processor, and clustered with its starting capacitors C6 and C7.

2.2 Power Supply

The board is provided with a +5V power supply using a Intersil LT1521CST-5 low dropout linear regulator. This regulator can supply up to 300 mA at 5V, with a dropout voltage of 0.5 V. It is rated for input voltages up to +20.0 V DC and is protected against reverse polarisation to -20 V DC. Line regulation is less than 20 mV over the range of rated input voltages, whilst load regulation is better that 55 mV for a full load step. A green LED is provided to indicate power on.

V_{SS} (+0V) is brought out to all connectors, at the *highest-numbered pin* on each connector.

2.3 Mechanical Dimensions

The circuit board measures 83.0×44.0 mm and is provided with four 3.5 mm diameter mounting holes at 77.0×25.0 mm centres. The silkscreen layer circles around these holes are of diameter 6.0 mm.

2.4 Microcontroller Connectors

All connections to the microcontroller ports are through 0.1 inch-grid header pins.

2.5 Power Supply Outputs

Power at +5.0 V (regulated) is available on connector X2 at the left side of the board and X9 near the right side. These connectors are 2-pin SIL header strips.

Table 1: Power connector X1A and X1B.

Pin	Signal
1	+5.5 V to +20.0 V input
2	+0.0 V input

Table 2: Power connectors X2 and X9.

Pin	Signal
1	+5.0 V input
2	+0.0 V input

2.5.1 Digital I/O signals

Connectors for each of the PIC18 ports are placed near the top and bottom edges of the board, with Pin 1 on the left of each connector. Pinouts of the connectors are given in Tables 3 to 7.

Table 3: PORTA connector, X3.

Pin	Signal
X3.1	PortA.0
X3.2	PortA.1
X3.3	PortA.2
X3.4	PortA.3
X3.5	PortA.4
X3.6	PortA.5
X3.7	+0 V

Table 4: PORTB connector, X4.

Pin	Signal
X4.1	PortB.0
X4.2	PortB.1
X4.3	PortB.2
X4.4	PortB.3
X4.5	PortB.4 (LED)
X4.6	PortB.5
X4.7	PortB.6
X4.8	PortB.7
X4.9	+0 V

Table 5: PORTC connector, X5.

Pin	Signal
X5.1	PortC.0
X5.2	PortC.1
X5.3	PortC.2
X5.4	PortC.3
X5.5	PortC.4
X5.6	PortC.5
X5.7	PortC.6
X5.8	PortC.7
X5.9	+0 V

Table 6: PORTD connector, X6.

Pin	Signal
X6.1	PortD.0
X6.2	PortD.1
X6.3	PortD.2
X6.4	PortD.3
X6.5	PortD.4
X6.6	PortD.5
X6.7	PortD.6
X6.8	PortD.7
X6.9	+0 V

Table 7: PORTE connector, X7.

Pin	Signal
X7.1	PortE.0
X7.2	PortE.1
X7.3	PortE.2
X7.4	+0 V

3 References

—. LT1521 Series Data Sheet (1521335FB). Linear Technology, nd.

—. HIN202E to HIN241E LT1009 Series Data Sheet. Intersil, 2005.

—. PIC18F2420/2520/4420/4520 Data Sheet (DS39631E). Microchip, 2008.

Horowitz, P & Hill, W. *The Art of Electronics*. Cambridge University Press, 2ed., 1989.

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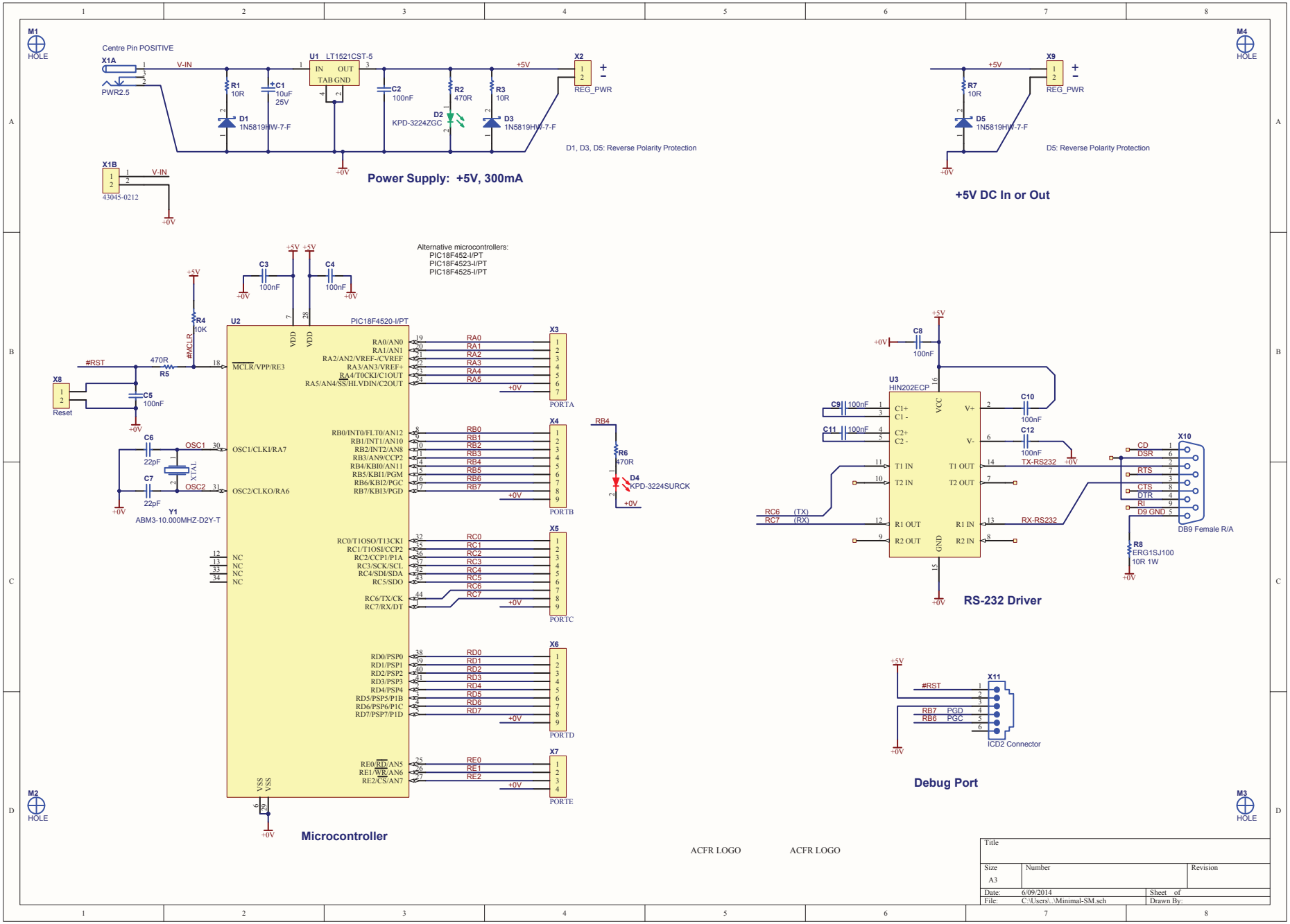

Figure 2: MNML•PIC•18 board schematic.