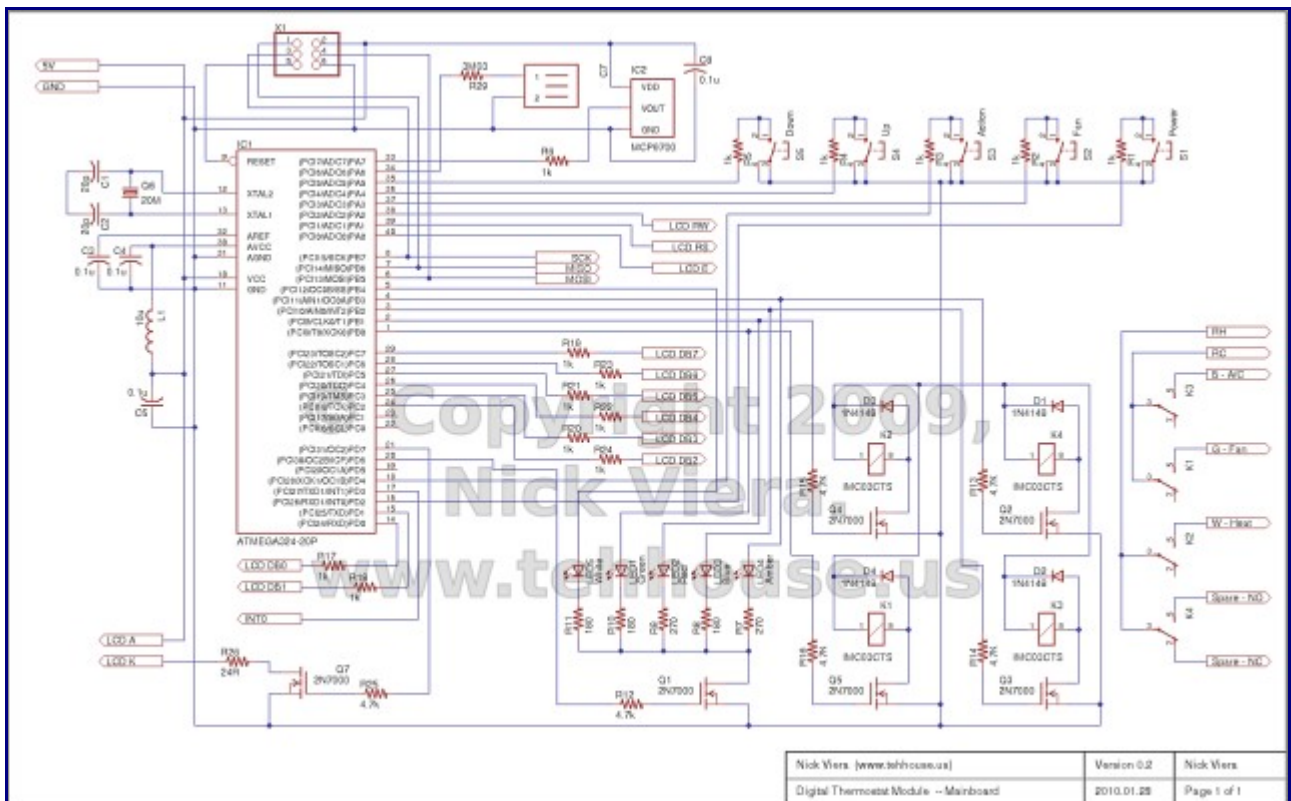


Mainboard (Microcontroller) Design

2010-02-01 20:02:34 by Nick

I've completed a preliminary schematic and parts list for the mainboard (microcontroller board) for the Digital Thermostat Module. The mainboard components are a mixed combination of 5 Volt and 3.3 Volt components. The biggest issue at this point in the design is having enough I/O pins available on the ATmega324P. One change I have planned to make is reduce the number of pushbutton switches from 6 to 5 to free up an extra I/O pin. I believe that the reduction in the number of switches to 5 will not negatively impact the usability of the design. The preliminary schematic is shown below.



NOTES:

- The oscillator components (Q6, C1, C2) may be removed in a future revision if the microcontroller code runs fast enough with a slower clock and doesn't need the extra speed.
- Q1 and Q7 will be used to provide dimming of the LCD backlight and LED indicator lights on the thermostat (to reduce power consumption and allow for user adjustment)
- The relays for the thermostat functions must be able to handle at least 24VAC and 1 Amp at their contacts to be useful for controlling standard residential HVAC systems.
- All the relays are switched by the microcontroller using FETs, since the relay coils require more current than the microcontroller ports can sink/source.
- The switches are not debounced in hardware, but will instead be debounced using a combination of software and hardware timers in the microcontroller.

Parts List														
Part ID	Type	Attr.	Temperature		Package	Digkey Part	Manufacturer Part	Unit Price			Qty	Extended Price		
			Min.	Max.				x1	x25	x100		x1	x25	x100
	Crystal	32.768K, 6pf	-20	70	Cylinder	SER3205-ND	C-002RX 32.7680K-E PB	0.32	0.27	0.18	1	0.32	0.27	0.18
IC3	IC	RTC, I2C	-40	85	DIP-8	DS1337+-ND	DS1337+	2.41	1.82	1.07	1	2.41	1.82	1.07
S1-5	Switch	SPST, mom, 150gf	-25	70	6mm square	SW403-ND	B3F-1022	0.29	0.26	0.21	5	1.45	1.31	1.05
	Socket	DIP-14, 0.3" wide, open			DIP-14	A100205-ND	1-390261-3	0.15	0.12	0.09	1	0.15	0.12	0.09
	Socket	DIP-40 wide			DIP-40	3M5471-ND	4840-6000-CP	0.42	0.36	0.29	1	0.42	0.36	0.29
	Socket	DIP-28, 0.3" wide, open			DIP-28	A100210-ND	1-390261-9	0.36	0.29	0.23	1	0.36	0.29	0.23
X1	Connector	2x3-pin, 2.54mm grid			Rectangle	609-2845-ND	75069-131LF	0.88	0.45	0.38	1	0.88	0.45	0.38
IC1	IC	Atmega324, 32k, 20MHz	-40	85	DIP-40	ATMEGA324P-20PU-ND	ATMEGA324P-20PU	5.59	4.21	3.81	1	5.59	4.21	3.81
C7	IC	Humidity, 10-95%RH	-40	120	SIP-2	480-2904-ND	HCH-1000-002	5.94	3.66	3.23	1	5.94	3.66	3.23
IC2	IC	Temp. -40-125C, +/-2C	-40	125	T0-92	MCP9700A-E/TO-ND	MCP9700A-E/TO	0.34	0.26	0.24	1	0.34	0.26	0.24
L1	Inductor	10uH, 210mA	-40	105	1008 (2520)	445-1750-1-ND	NLCV25T-100K-PF	0.27	0.22	0.18	1	0.27	0.22	0.18
C1,2	Capacitor	20pF, 50V, ceramic	-55	125	2.5mm grid	490-3703-ND	RPE5C1H200J2P1Z03B	0.32	0.24	0.17	2	0.64	0.48	0.34
Q6	Crystal	20MHz, 20pF			HC49US	631-1111-ND	FOXSLF200-20	0.53	0.45	0.30	1	0.53	0.45	0.30
C3-6	Capacitor	0.1u, 50v, ceramic	-55	125	2.54mm grid	BC1084CT-ND	K104K15X7RF5TL2	0.08	0.08	0.06	4	0.32	0.32	0.23
R1-6,17-2	Resistor	1k, 5%, carbon	-55	155	Axial	CF141KJRCT-ND	CF 14 1K 5% R	0.08	0.05	0.02	14	1.12	0.74	0.31
R7,9	Resistor	270, 5%, carbon	-55	155	Axial	CF14270JRCT-ND	CF 14 270 5% R	0.08	0.05	0.02	2	0.16	0.11	0.04
R8,10,11	Resistor	180, 5%, carbon	-55	155	Axial	CF14180JRCT-ND	CF 14 180 5% R	0.08	0.05	0.02	3	0.24	0.16	0.07
K1-4	Relay	SPDT, 125V@5A, 5V	-40	85	Rectangle	PB1249-ND	IMC03CT5	2.62	2.29	1.64	4	10.48	9.16	6.54
D1-4	Diode	Fast, 200mA, 100V	-65	175	D035	1N4148FS-ND	1N4148	0.04	0.03	0.02	4	0.16	0.13	0.09
Q2-5,7	Transistor	MOSFET, 60V, 200mA	-55	150	T0-92	2N7000 D26ZCT-ND	2N7000	0.26	0.20	0.14	5	1.30	0.98	0.68
R13-16,25	Resistor	4.7k, 5%, carbon	-55	155	Axial	CF1447KJRCT-ND	CF 14 4.7K 5% R	0.08	0.05	0.02	5	0.40	0.27	0.11
Parts List - Microcontroller Mainboard - Nick Viera - 2010.01.28								Total:			59	33.48	25.76	19.47