IR / RS-232 Transceiver - 96/04/23 15:05

The IR / RS-232 Transceiver module will convert the signal from a UART port into infrared (IR) format, and from IR back to UART format. It will handle baud rates from 300 to 38400 baud. The IR format supports half-duplex communications only. The IR signal is compatible with the HP48 series calculators. Although I have not tried, the IR signal closely resembles the IrDA format, and I suspect this module should be able to talk to laptop computers and other devices with an IrDA port. The RS-232 port is a DTE port, which means it can be plugged directly into a modem or serial printer. For connection into a PC computer, a null modem cable is required (the wiring diagram is included). The IR format dictates half-duplex communications. The module will enforce this by disabling the IR receiver while the IR transmitter is transmitting data.

The module can use either a 6V battery or a 9V battery. A 6V battery (like 4-AA cells) will last longer, but the regulator is bypassed. I find a 9V battery is more portable. The current drain is 60mA idle, 70mA during file transfer. Don't plug the 9V battery into the 6V connector. That would be bad, very bad!

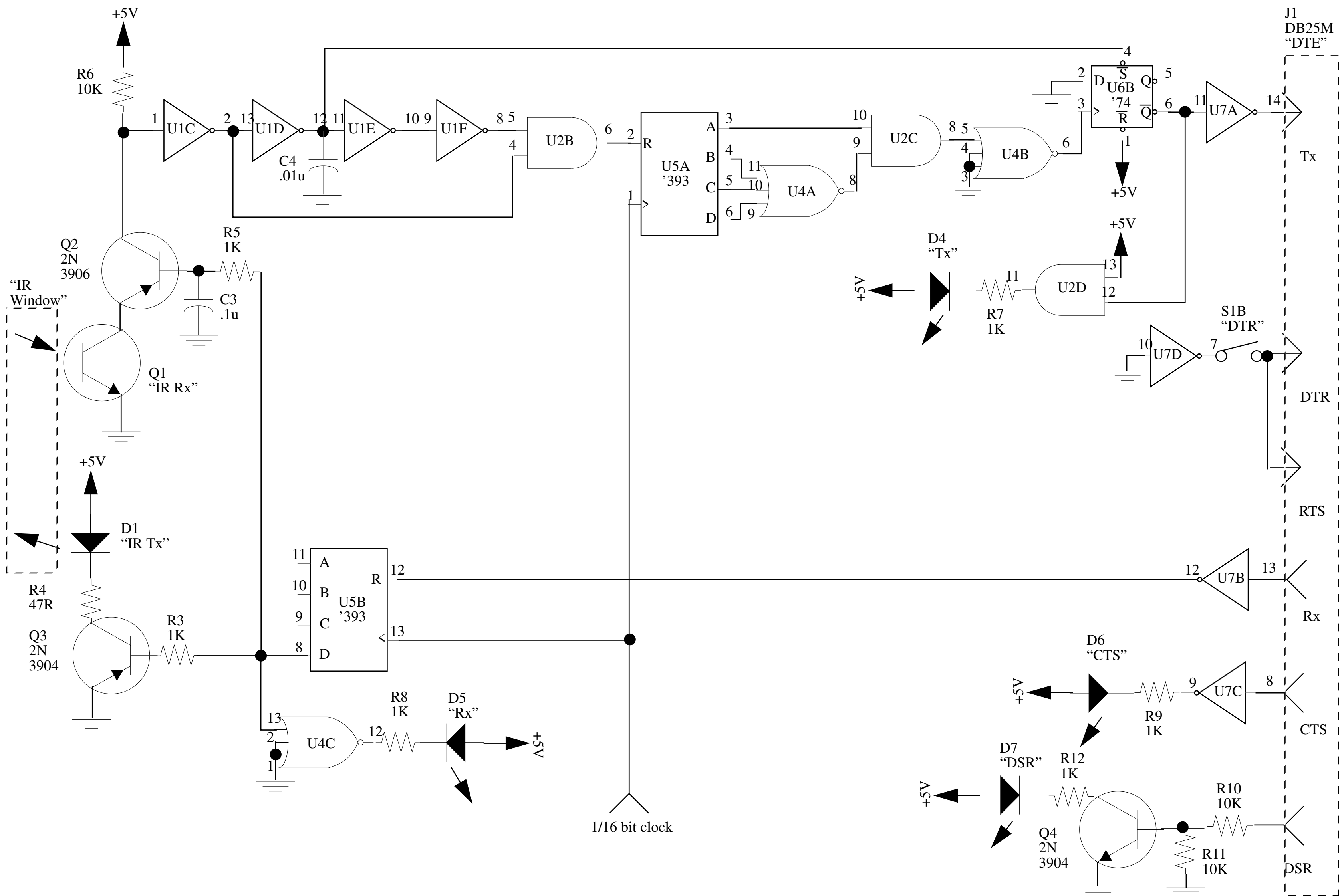
The basic design is based on the document at "http://www.ee.ualberta.ca/~charro/cookbook/optic/HP48SXIR.asc" by Tony Duell (ARD@PVA.BRIS.AC.UK). The IR transmitter and IR receiver runs on a 16x clock source for the desired baud rate. U1A, U1B, U2A form the cristal oscillator. C2 is critical. The 2.4576MHz crystal do not like to oscillate at its fundamental frequency (at least the ones I tried don't). C2 will suppress the overtones. U3 and U6A form the 16X baud rate generator. The baud rate is selectable using S1. The IR transmitter is quite simple. It will send a 1/2-bit wide pulse for every SPACE on the RS-232 port. The IR receiver uses U1, C4 to shape the IR pulse going to U6B pin 4, and to create a reset pulse to synchronize U5A with the UART on the IR side. When the IR transmitter is active (D1 is on), Q1 is disabled by Q2. For a short duration after the D1 switches off, Q1 will still be saturated and require a recovery period. This is provided by C3, R5.

Four LED's show the status of the RS-232 DTE interface. The Tx, Rx, CTS, and DSR lines are monitored. DTR and RTS lines can be pulled high, or left unpowered. This is selectable using S1. I chose a DTE pin-out for the RS-232 port because this allows me to plug the module directly into a modem or serial printer. A null modem cable is required to connect to a PC. The wiring diagram for this is included.

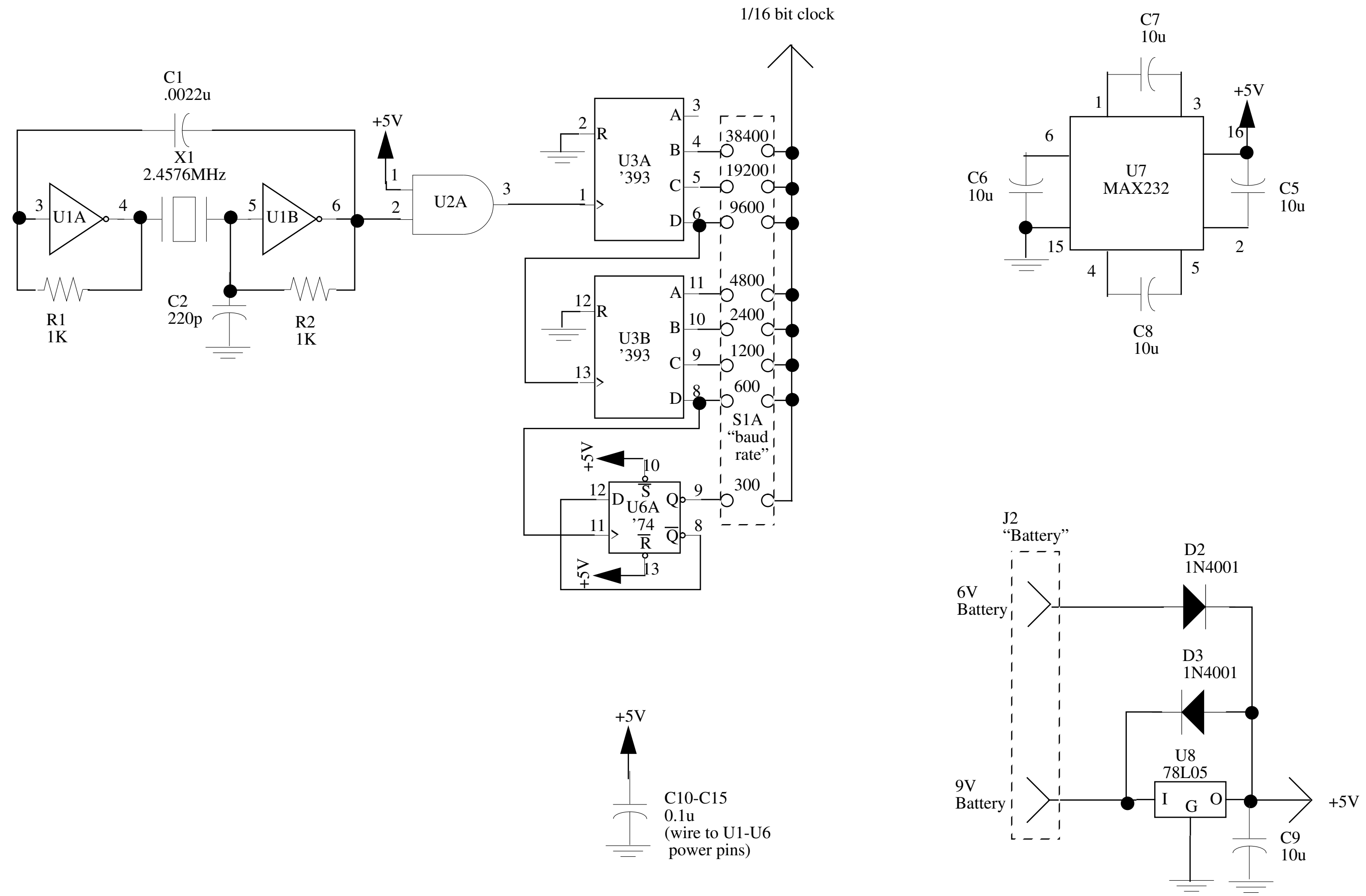
My next project will be a DAT cassette size serial/parallel converter so I can use my EPSON printer from the HP48.

Enjoy,
Tom Wong (tomwong@bnr.ca / tomwong@nortel.ca)
<Standard disclaimers here; freeware; no warranties; not responsible for anything; email your comments; etc. etc.>

IR / RS-232 Transceiver - schematic part 1/2 - IR to RS-232 converter



IR / RS-232 Transceiver - schematic part 2/2 - clock source and power supply



IR / RS-232 Transceiver - parts list

Resistors: (all resistors 1/4W)

R1-3, R5, R7-9, R12	1K
R4	47ohms
R6, R10, R11	10K

Capacitors:

C1	.0022uF ceramic disc
C2	220pF ceramic disc
C3, C10-15	0.1uF ceramic disc
C4	.01uF ceramic disc
C5-9	10uF electrolytic

Diodes:

D1	IR emitter
D2, D3	1N4001 rectifier diode
D4-7	Red LED

Transistors:

Q1	IR phototransistor
Q2	2N3906 PNP transistor
Q3, Q4	2N3904 NPN transistor

Integrated circuits:

U1	74LS04 hex inverter
U2	74LS08 quad 2-input AND gate
U3, U5	74LS393 dual 4-bit binary counter
U4	74LS27 triple 3-input NOR gate
U6	74LS74 dual R-S flip flop
U7	MAX232 RS-232 drivers with power inverter
U8	78L05 low power 5V regulator (TO-92)

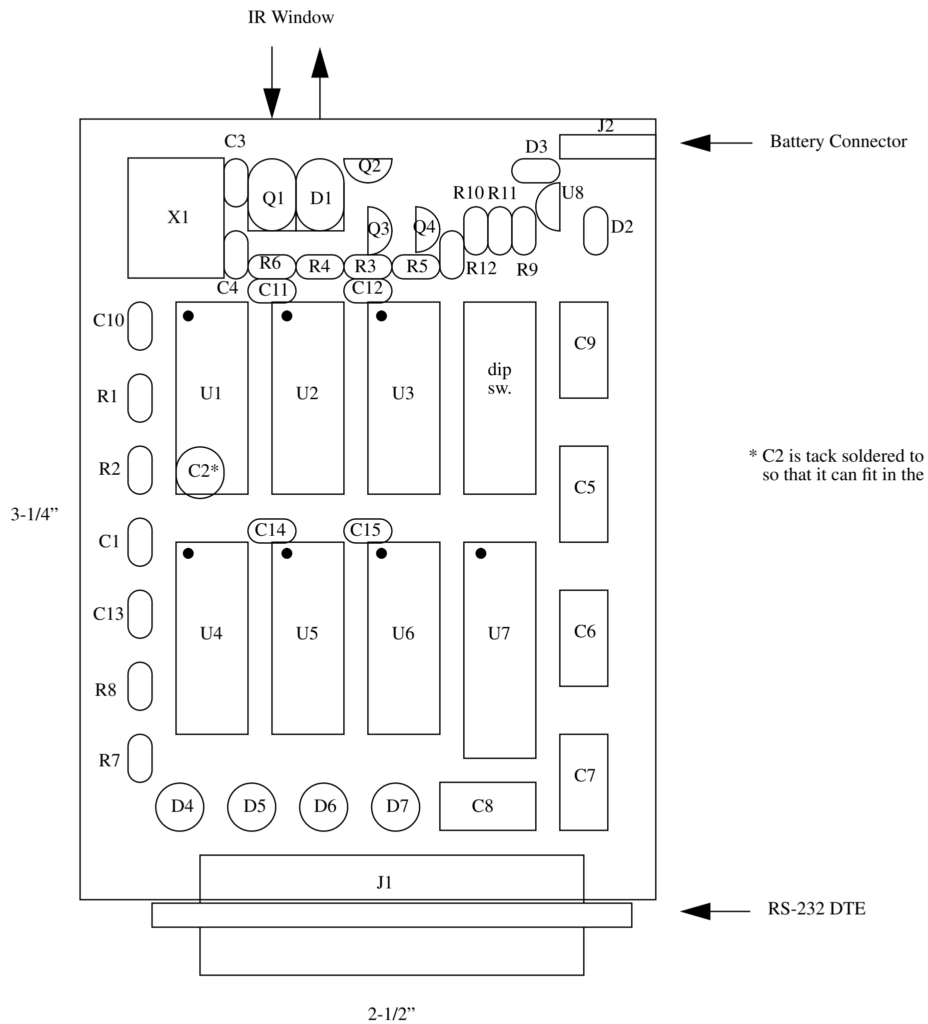
Miscellaneous:

X1	2.4576MHz crystal
S1	9-position DIP switch
B1	6V or 9V battery
J1	DB25M Male connector
J2	Battery connector
J3, J4	DB25F Female connectors for null modem cable

Printed circuit board
Wire wrap wire used for point-to-point wiring
Box (DAT cassette case)
8-connector coax wire for null modem cable

If you have any questions or comments, please mail me at tomwong@bnr.ca or tomwong@nortel.ca.

IR / RS-232 Transceiver - parts placement diagram



* C2 is tack soldered to pins on U1 on component side so that it can fit in the DAT case.

IR / RS-232 Transceiver - system wiring