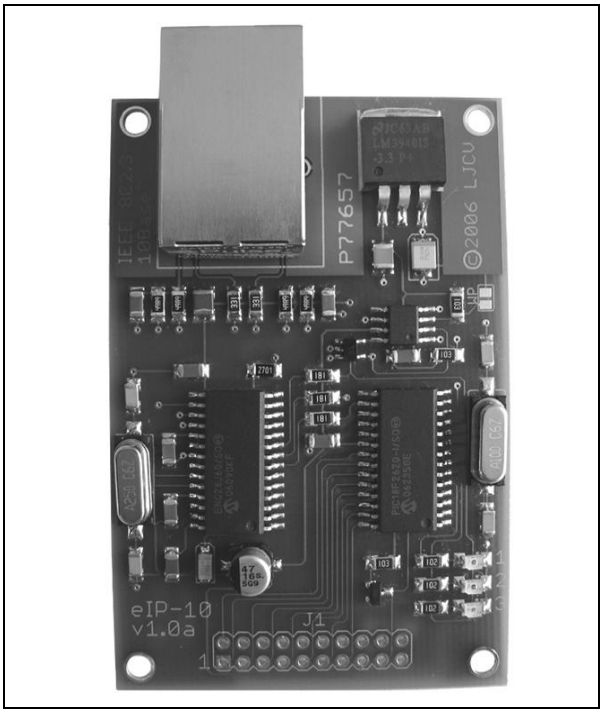
LJCV
Electronics

eIP-10

Embedded TCP/IP 10-BaseT Network Module

Features

- 8-bit reprogrammable Microcontroller with Enhanced Flash program memory, EEPROM and Static RAM data memory
- On board 10Mbps Ethernet controller, and RJ45 jack for network connection
- Small 2x3” circuit board footprint
- Single +5VDC supply
- Microchip’s TCP/IP protocol stack, with IPv4, UDP, TCP, DHCP, ICMP, FTP, and HTTP support
- Ethernet Boot Loader
- On board Serial Flash EEPROM
- 40MHz CPU clock
- IEEE 802.3 10BaseT compliant
- Fully assembled and tested



Description

The eIP-10 is a small network module implemented with Microchip Technology PIC18F2620 8-bit Microcontroller and ENC28J60 Ethernet Network Controller.

The circuit board includes all required components for both controllers, plus a serial 256Kbit EEPROM for storage of board configuration, basic HTML pages and graphic files, three LEDs for health and board activity, and a RJ-45 jack with integrated magnetics and built-in Link and Activity LEDs for connection to an Ethernet Local Area Network.

Microcontroller SPI™ bus signals, USART Tx and Rx, ICSP™ interface, and unused I/O pins are all routed to the board interface connector.

Applications

- Remote control and monitoring
- Data capture and logging
- Industrial Automation
- Building Automation
- Appliance remote management
- Robotics
- Microcontroller Research and Development
- TCP/IP Research and Development
- Serial interface (RS-232/RS-485) to Ethernet bridge

General Description

The eIP-10 board combines the flexibility and features of a small package PIC18F2620 8-bit microcontroller (MCU)[B1] from Microchip Technology with their new ENC28J60[B2] IEEE 802.3 Stand-Alone Ethernet controller with integrated SPI bus interface, MAC and 10BASE-T PHY (ENC).

The board includes all support components for both controllers plus a 256Kbit serial EEPROM for application and user data storage.

Communication between both controllers is implemented using the standard SPI (Serial Peripheral Interface) signals SCK (clock), SDI (serial data input) and SDO (serial data output). The RC0 I/O port of the MCU is used to drive the $\overline{CS}$ (chip select) signal of the ENC.

The SPI bus is also shared with the serial EEPROM, in this case the RC1 I/O port of the MCU is used to drive the $\overline{CS}$ signal of the EEPROM. The board includes next to the EEPROM chip a small solder jumper labeled WP, normally this jumper is open enabling the modification of the EEPROM STATUS register (refer to the 25LC256 Data Sheet[B3] for additional information about data protection).

Since the SPI bus can be shared with additional devices all SPI signals are present on the board interface connector J1.

Clock source for the Microcontroller is provided by a 10.00MHz parallel cut crystal. To achieve higher performance and recommended clock speeds for the SPI bus the Microcontroller is normally configured with HSPLL enabled for an internal clock speed of 40MHz.

The board also includes three status LEDs (marked 1, 2 and 3) for indication of MCU program status and activity. The LEDs are connected to RA3, RA4, and RA5 I/O ports of the MCU.

All remaining I/O ports of the MCU (RA0, RA1, RA2, RB0-RB7, and RC2) are present on the board interface connector J1.

The MCU reset logic is implemented with a 10K resistor and a high speed switching diode, the MCU reset or MCLR signal is also present on the J1 board interface connector to complete the MCU ICSP™ (In Circuit Serial Programming) interface.

The board requires a stable +5V DC supply with at least 200 mA (this requirement varies according to the use of available I/O ports).

Complete schematics of the eIP-10 are included in Appendix A.

The MCU is pre-loaded with Brush Electronics Ethernet Bood Loader[B7].

Complete source code for the TCP/IP stack is available from Microchip for download.

Microcontroller

The PIC18F2620 is a high performance 8-bit Harvard architecture microcontroller with a reduced instruction set, that includes in the chip 64Kbytes of enhanced Flash memory (equivalent to 32,768 single word instructions), 3,986 bytes of static RAM, 1,024 bytes of data EEPROM, 25 general purpose bidirectional I/O lines, of which up to 10 can be configured as channels for the 10-bit A/D converter, dual analog comparators, a Master Synchronous Serial Port (MSSP) module supporting the 3-wire SPI™ bus, an Enhanced Addressable USART module, and more.

For a detailed feature description and complete documentation of the Microcontroller, please refer to Microchip's PIC18F2620 Data Sheet[B1] and the PIC18 Family Reference Manual[B6].

Ethernet Controller

Microchip's ENC28J60 is an IEEE 802.3 Stand Alone Ethernet controller with integrated MAC and 10BASE-T PHY modules. It has an 8KBytes dual port static RAM buffer with hardware assisted circular receive FIFO and CRC generation.

It supports Unicast, Multicast and Broadcast packets, and programmable receive packet filtering.

The hardware CRC calculation module facilitates the in-buffer checksum generation for various network protocols.

It also includes two programmable LED outputs for LINK, Rx/Tx activity and collision status. These two outputs drive the LEDs present in the eIP-10 RJ-45 jack. By default the yellow LED indicates LINK status and the green LED Rx/Tx activity.

For a detailed feature description and complete documentation of the Ethernet Controller, please refer to Microchip's ENC28J60 Data Sheet[B2].

Serial EEPROM

The serial EEPROM included in the eIP-10 board is a Microchip 25LC256.

This external 32Kbytes memory facilitates the non-volatile storage of configuration information, user data, HTML pages and graphics, etc.

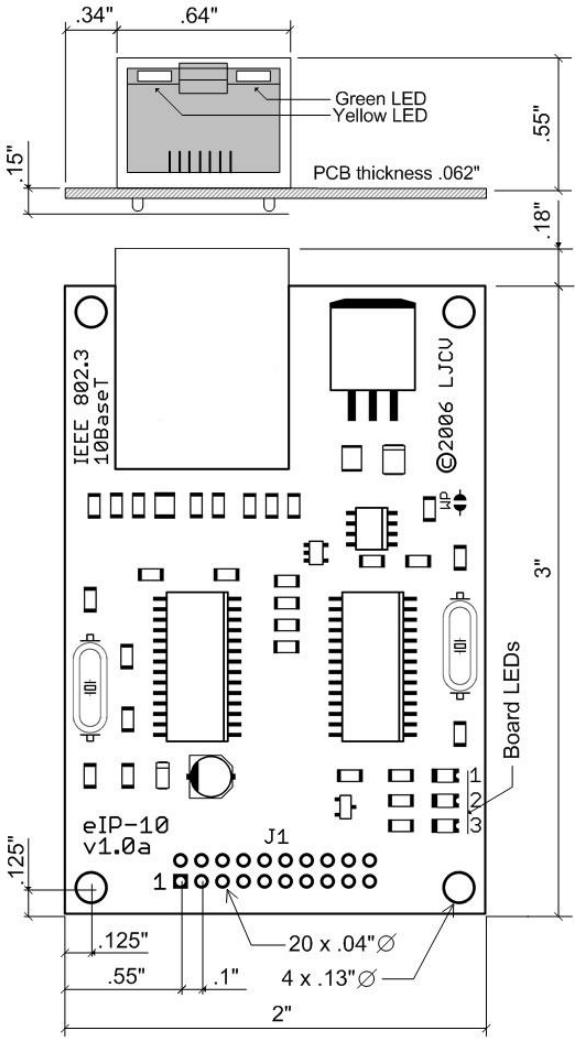
The EEPROM endurance is 1,000,000 read/write cycles with more than 200 years of data retention.

For a detailed feature description and complete documentation of the Serial EEPROM, please refer to Microchip's 25LC256 Data Sheet[B3].

Board Interface (J1)

Connections to the board are performed via the J1 connector interface; it accommodates any standard 20 pin two-row header with .100" pitch.

Physical Dimensions



Note: Drawing not to scale

All dimensions are in inches.

J1 Pin Out

(Shown from component side)

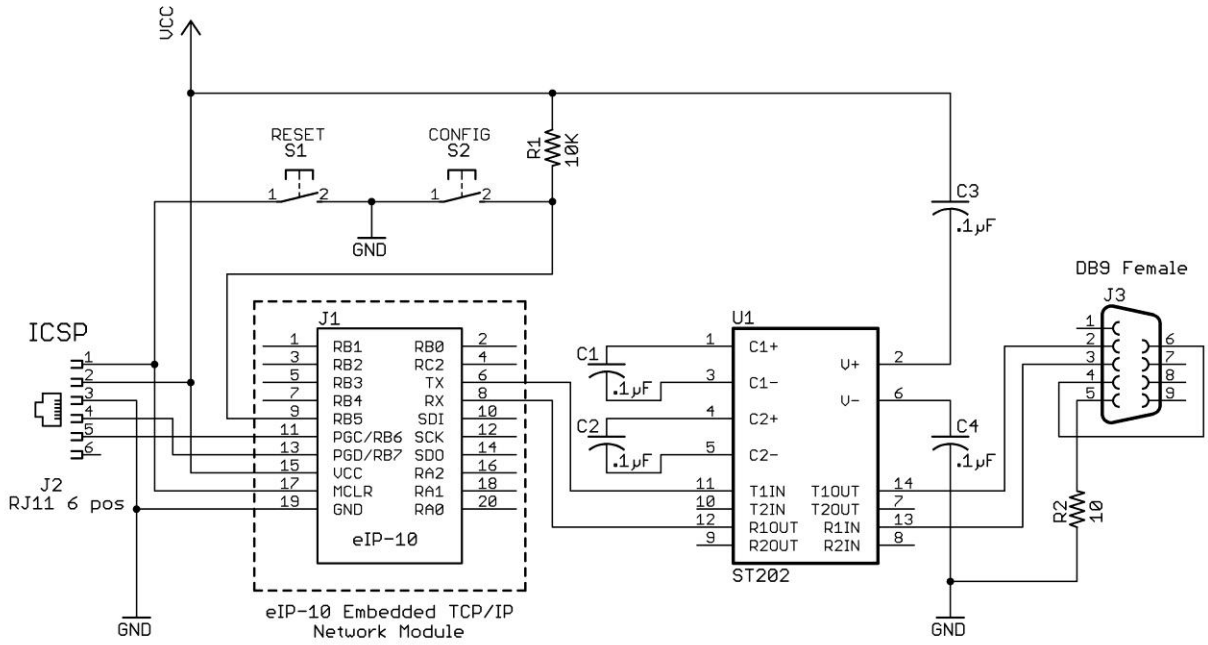
2	4	6	8	10	12	14	16	18	20
RB0 INT	RC2 CPP	RC6 TX	RC7 RX	RC4 SDI	RC3 SCK	RC5 SDO	RA2 AN2	RA1 AN1	RA0 AN0
RB1	RB2	RB3	RB4	RB5 PGM	RB6 PGC	RB7 PGD	Vcc +5VDC	~MCLR VPP	GND
1	3	5	7	9	11	13	15	17	19

Connecting the eIP-10

The eIP-10 is shipped fully assembled and tested. The Microcontroller program memory is pre-loaded with Brush Electronics Ethernet Boot Loader.

The only connections required to get the board up and running are V_{CC} = 5V, GND and a 10BASE-T cable to your local area network or PC (be aware that if you connect the 10BASE-T cable directly to a PC Network Interface Card a crossover cable is needed).

The schematic below shows a basic circuit with the eIP-10 that includes two pushbutton switches, S1 to force a hardware RESET of the Microcontroller, and S2 connected to the RB5 I/O Port to enter in configuration mode via the serial interface (if enabled by firmware). The schematic also shows a RJ-11 6 position jack for the ICSP™ (In Circuit Serial Programming) interface to the Microcontroller, which enables tools such as Microchip's In-Circuit Debugger/Programmer MPLAB® ICD2 to access and program the MCU.



Note: ST202 and additional components not included on eIP-10 board

Electrical Characteristics

Absolute Maximum Ratings

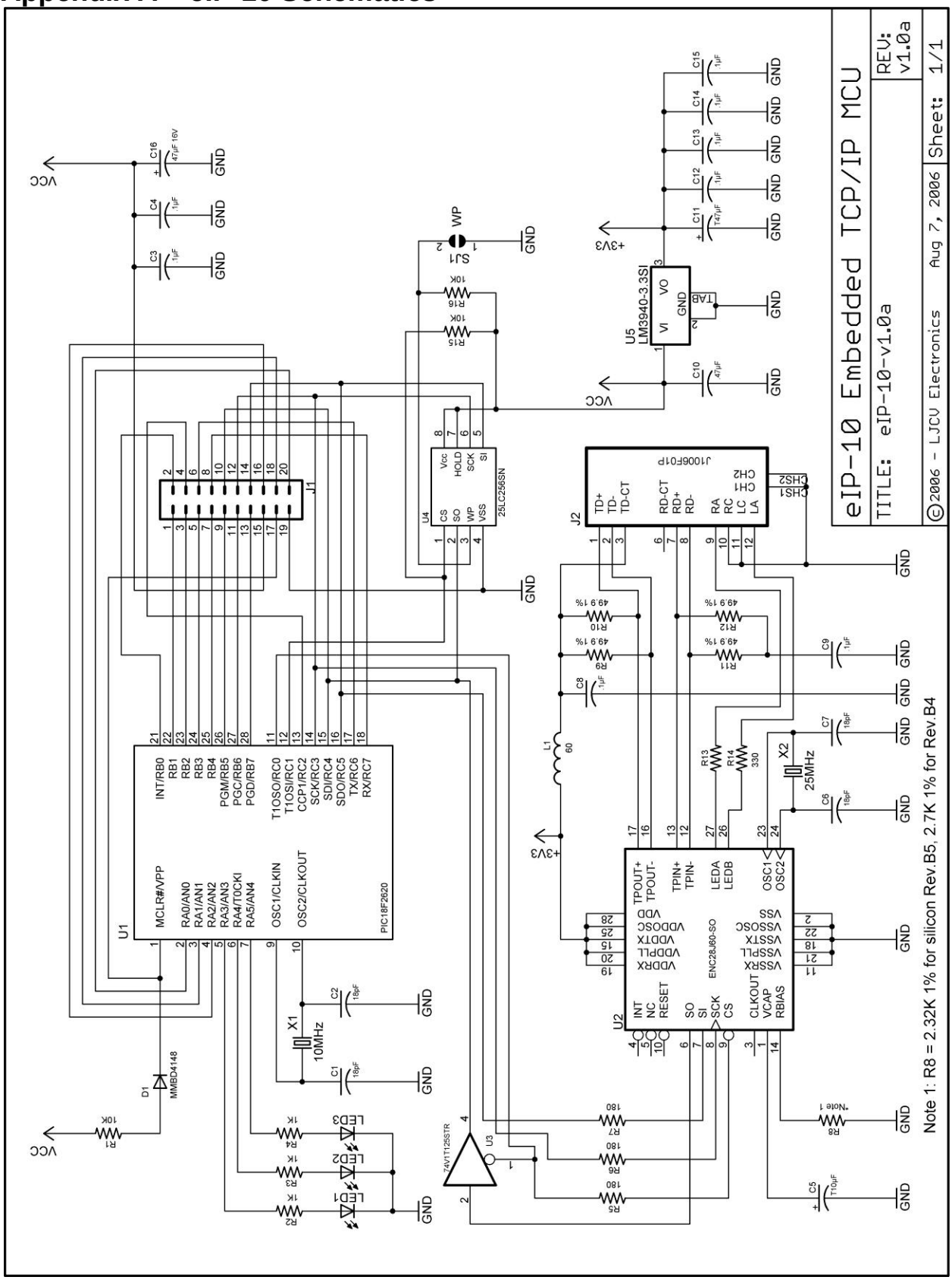
Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.3 to +6.5	V
I_{SUP}	Supply Current (@ V_{CC}=5.0V)	200	mA
T_{OP}	Operating Temperature	0 to +70	°C
T_{STO}	Storage Temperature	-50 to +150	°C

DC Normal Operating Characteristics

Symbol	Parameter	Value			Unit
		Min	Typ	Max	
V_{CC}	Supply Voltage	4.2	5.0	5.5	V
I_{SUP}	Supply Current (@V_{CC}=4.75V)	140	170	190	mA
V_{IL}	Input Low Voltage (I/O ports)	-	-	0.8	V
V_{IH}	Input High Voltage (I/O ports)	2.0	5.0	VCC	V
V_{OL}	Output Low Voltage (I/O ports)	-	0.6	0.6	V
V_{OH}	Output High Voltage (I/O ports)	V_{CC}-0.7	-	-	V

For complete AC and DC operating characteristics please refer to Microchip's PIC18F2620 Data Sheet[B1].

Appendix A – eIP-10 Schematics



Appendix B – Technical References

[B1] PIC18F2620 Enhanced Flash 8-bit Microcontroller Data Sheet, Microchip Technology Inc., 2004, Document Number DS39626B.

[B2] ENC28J60 Stand-Alone Ethernet Controller Data Sheet, Microchip Technology Inc., 2006, Document Number DS39662B.

ENC28J60 Rev. B4 Silicon Errata, Microchip Technology Inc., 2006, Document Number DS80257C.

ENC28J60 Rev. B5 Silicon Errata, Microchip Technology Inc., 2006, Document Number DS80264C.

[B3] 25LC256 256K SPI™ Bus Serial EEPROM Data Sheet, Microchip Technology Inc., 2005, Document Number DS21822E.

[B4] Microchip TCP/IP Protocol Stack, available at *www.microchip.com/tcpip*.

[B5] Microchip MPLAB Integrated Development Environment, and Microchip MPLAB C18 Compiler, available at *www.microchip.com*.

[B6] PICmicro® 18C MCU Family Reference Manual, Microchip Technology Inc., 2000, Document Number DS39500A.

[B7] Brush Electronics Ethernet Boot Loader System, *www.brushelectronics.com*.

Revision History:

September 2006, Original data sheet document for eIP-10.
March 2010, Updated references to Microchip TCP/IP Stack.

Notes:

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