## ENC28J60 10-BaseT Network Interface Card

Features

- On board 10Mbps Ethernet controller, and RJ45 jack for network connection
- Small 1.3x2.5" circuit board footprint
- Selectable +5 or 3.3V DC supply
- On board voltage regulator and 3-State level conversion logic
- Microchip's TCP/IP protocol stack, with IPv4, UDP, TCP, DHCP, ICMP, FTP, and HTTP support
- Ethernet Boot Loader
- IEEE 802.3 10BaseT compliant
- Fully assembled and tested

Description

The nic28 is a small network interface card implemented with Microchip Technology new Stand-Alone ENC28J60 Ethernet Network Controller.

The circuit board includes all required components for the ethernet controller, plus a 3.3V Voltage Regulator and 3-State Buffer for level conversion, and a RJ-45 jack with integrated magnetics and built-in Link and Activity LEDs for connection to an Ethernet Local Area Network.

The nic28 can be used with any Microprocessor or Microcontroller supporting the industry standard SPI™ interface.
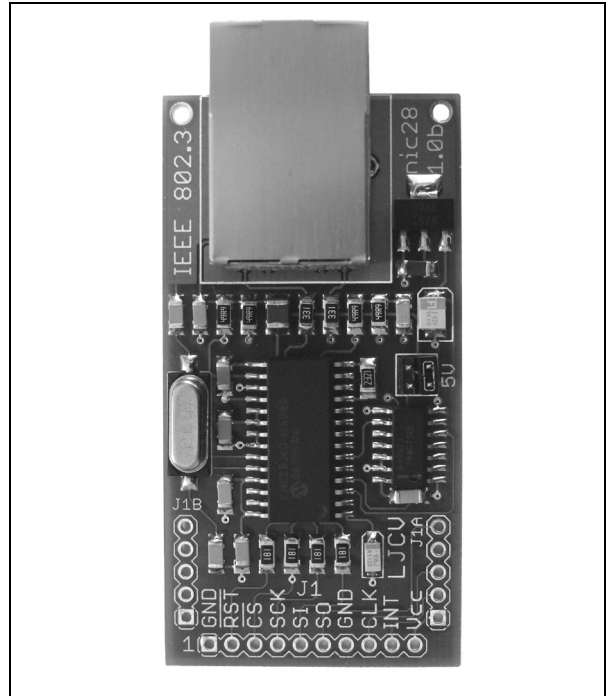
Applications

- 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

General Description

The nic28 is a small Network Interface Card based on Microchip Technology new ENC28J60[B1] 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 the Ethernet controller plus a 3.3V Voltage Regulator and a 3-State Buffer for level conversion for interfacing with +5V systems.

Communication with the ENC28J60 is implemented using the standard SPI (Serial Peripheral Interface) signals SCK (clock), SI (serial input), SO (serial output) and $\overline{CS}$ (chip select).

The board interface is completed with other signals from the ENC28J60 such as CLKOUT, INT and RESET.

Since the ENC28J60 inputs are 5V tolerant, no level conversion is required for the RESET, $\overline{CS}$, and SI signals, but a small resistor is added in series to reduce undershoots. INT, CLKOUT and SO are all buffered with a 3-State Buffer acting as a level translator and 3-State isolation for SO when the board is not selected ($\overline{CS}$ High State) facilitating sharing the SPI bus with other devices.

The board includes a small 2x2 jumper header to select the operating voltage; this enables the nic28 to be used in 5V or 3.3V applications.

The board requires a stable +5V DC supply with at least 160mA.

Complete schematics of the nic28 are included in Appendix A.

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[B1].

Software Drivers

A complete TCP/IP protocol stack[B2] with drivers supporting the ENC28J60 is available from Microchip Technology.
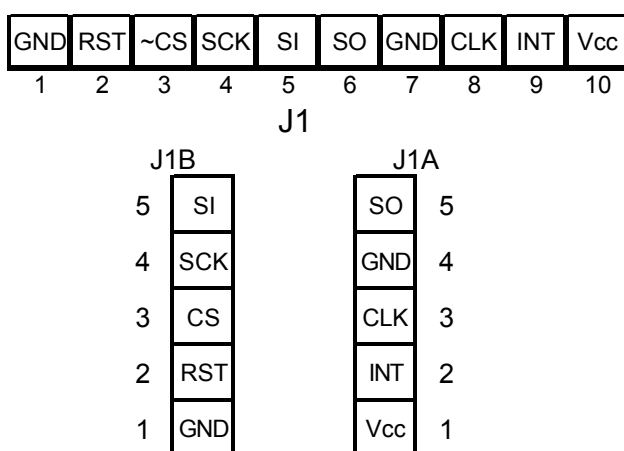
Also Brush Electronics developed an Ethernet Boot Loader System[B3] that also supports the ENC28J60 Ethernet controller.

Board Interface (J1, J1A/B)

Connections to the board are performed via the J1 connector interface; it accommodates any standard 10 pin header with .100" pitch.

Optionally all signals are also available in the two 5 pin headers J1A and J1B. This option is very useful when using the nic28 in a solderless prototype breadboard.

J1, J1A and J1B Pin Outs

GND	RST	~CS	SCK	SI	SO	GND	CLK	INT	Vcc
1	2	3	4	5	6	7	8	9	10

J1

J1B			J1A
5	SI	SO	5
4	SCK	GND	4
3	CS	CLK	3
2	RST	INT	2
1	GND	Vcc	1

Supply Voltage Selection

The voltage selection jumper has two positions. The position marked "5V" is for +5VDC supply operation, in this position the jumper inserts the 3.3V voltage regulator for the Ethernet controller and support components. The second position is for +3.3V supply operation, in this case the jumper connects the Vcc pins from J1 directly to the Ethernet controller and support components.
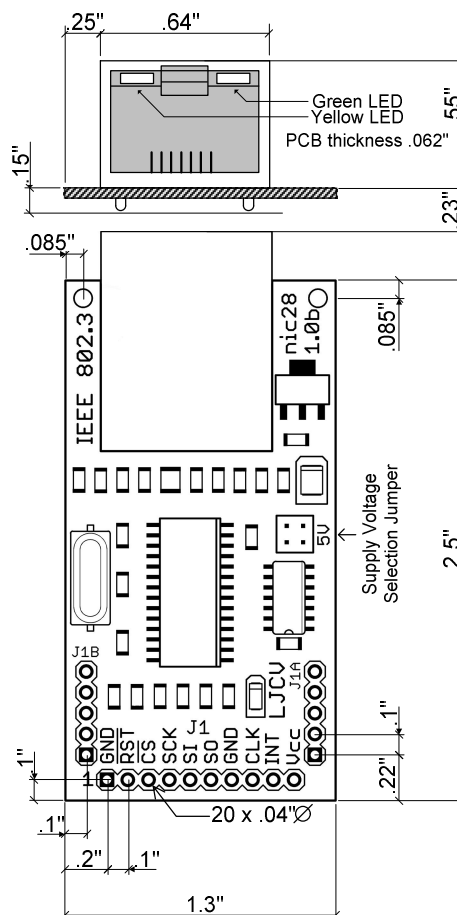

+5V Supply

+3.3V Supply
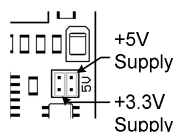
Voltage Selection Jumper

WARNING

By applying +5V to Vcc with the voltage selection jumper in the 3.3V position the Ethernet controller maximum admissible voltage for V_{DD}, V_{DDOSC}, V_{DDPLL}, V_{DDRX} and V_{DDTX} will be exceeded and may cause permanent damage to the Ethernet Controller.

Physical Dimensions

.25" .64"

Green LED
Yellow LED
PCB thickness .062"

.55"

.15"

.23"

.085"

IEEE 802.3

nic28 1.0b

.085"

Supply Voltage Selection Jumper

5V

2.5"

J1B

J1

GND RST CS SCK SI SO GND CLK INT Vcc

LJCU J1A

1"

.1"

20 x .04"⌀

.1"

.2" 1"

.22"

.1"

1.3"

Note: Drawing not to scale

All dimensions are in inches.

Electrical Characteristics

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.3 to +7.0	V
I_{SUP}	Supply Current (@ V_{CC}=4.75V)	160	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) Supply Current (@V_{CC}=3.30V)	140 135	150 145	155 150	mA
V_{IL}	Input Low Voltage (RST, CS, SCK, SI)	0	-	1.0	V
V_{IH}	Input High Voltage (RST, CS, SCK, SI)	2.25	-	5.5	V
V_{OL}	Output Low Voltage (SO, INT, CLK)	0.3	-	0.44	V
V_{OH}	Output High Voltage (I/O ports)	2.9	-	5.4	V

For complete AC and DC operating characteristics please refer to Microchip's ENC28J60 Data Sheet[B1].

Appendix A – nic28 Schematics
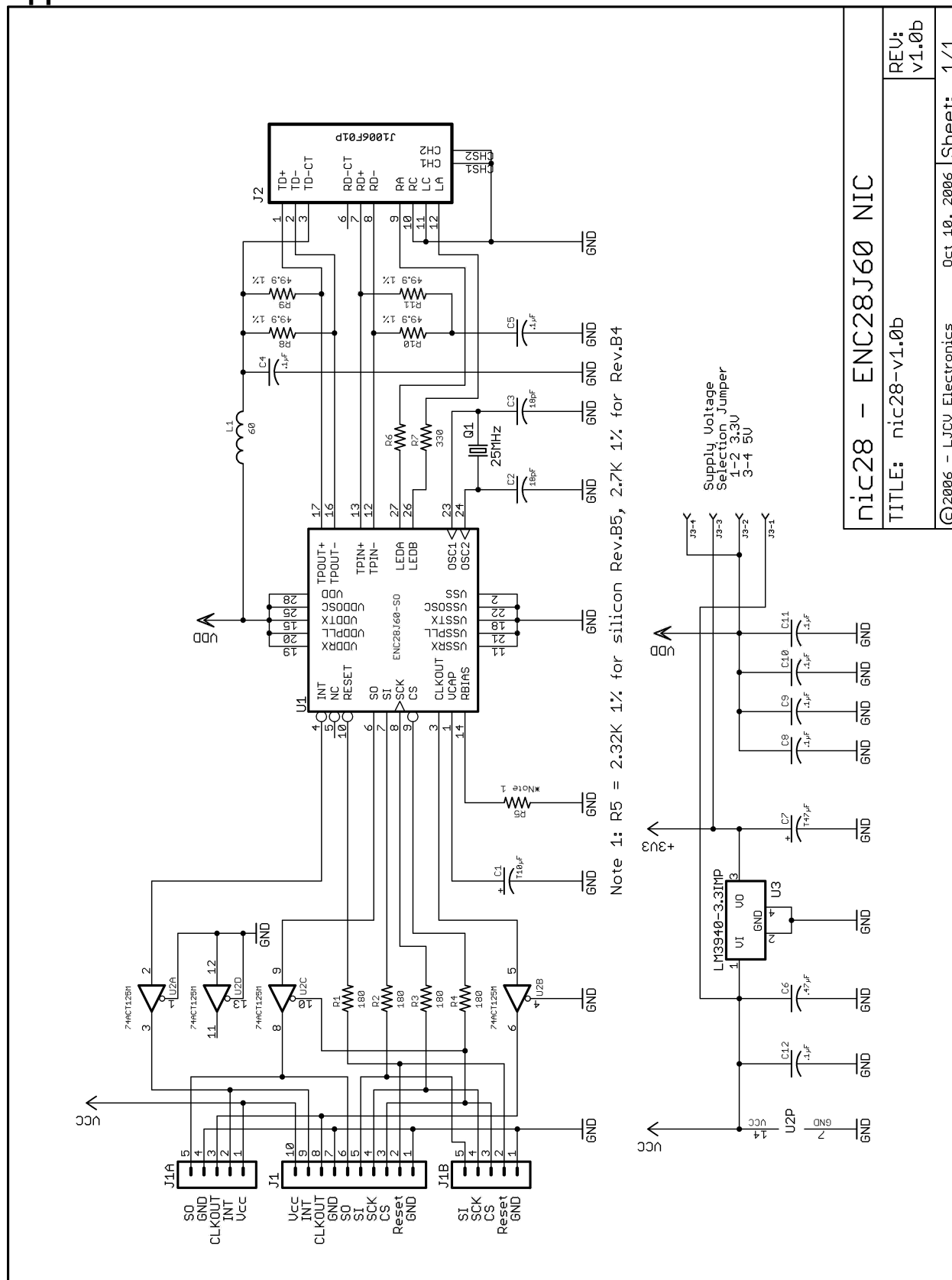
Appendix B – Technical References

[B1] ENC28J60 Stand-Alone Ethernet Controller Data Sheet, Microchip Technology Inc., 2006, Document Number DS39662B.

ENC28J60 Rev. B1 Silicon Errata, Microchip Technology Inc., 2006, Document Number DS80254D.

ENC28J60 Rev. B4 Silicon Errata, Microchip Technology Inc., 2006, Document Number DS80257D.

ENC28J60 Rev. B5 Silicon Errata, Microchip Technology Inc., 2006, Document Number DS80264D.

[B2] Microchip TCP/IP Protocol Stack, available at *www.microchip.com*.

[B3] Brush Electronics Ethernet Boot Loader System, *www.brushelectronics.com*.

Revision History:

October 2006, Original data sheet document for nic28.

Notes: