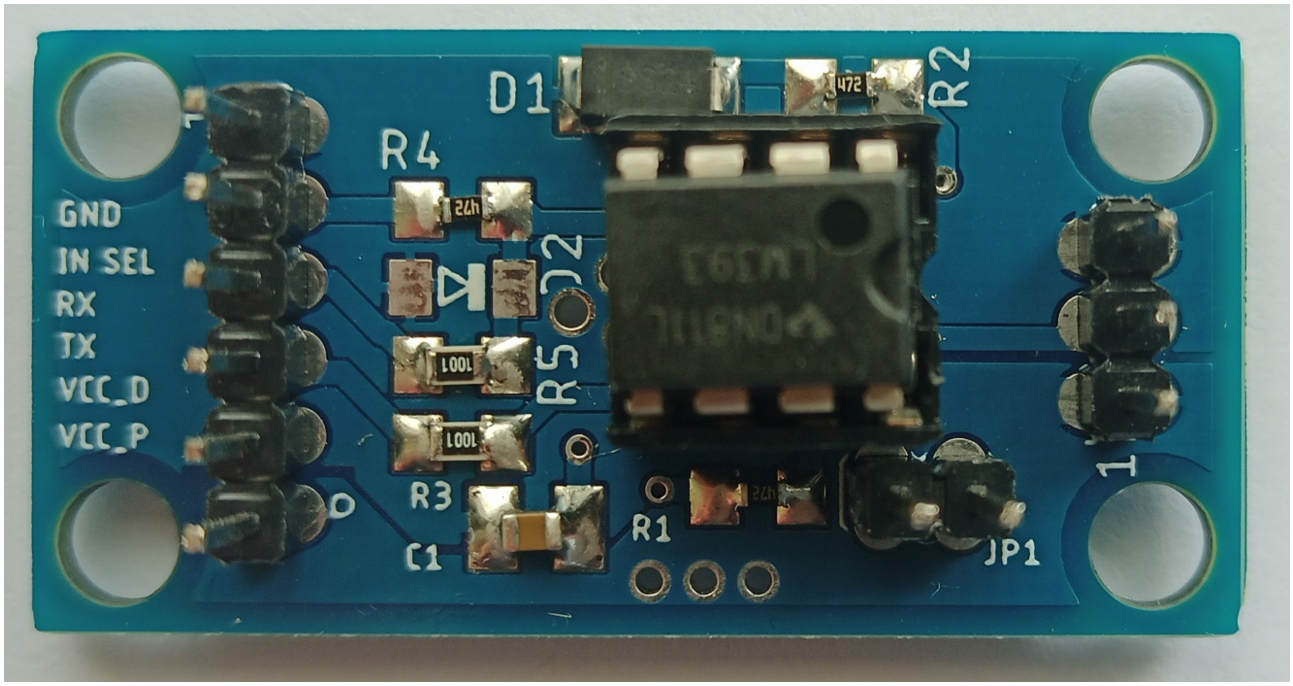
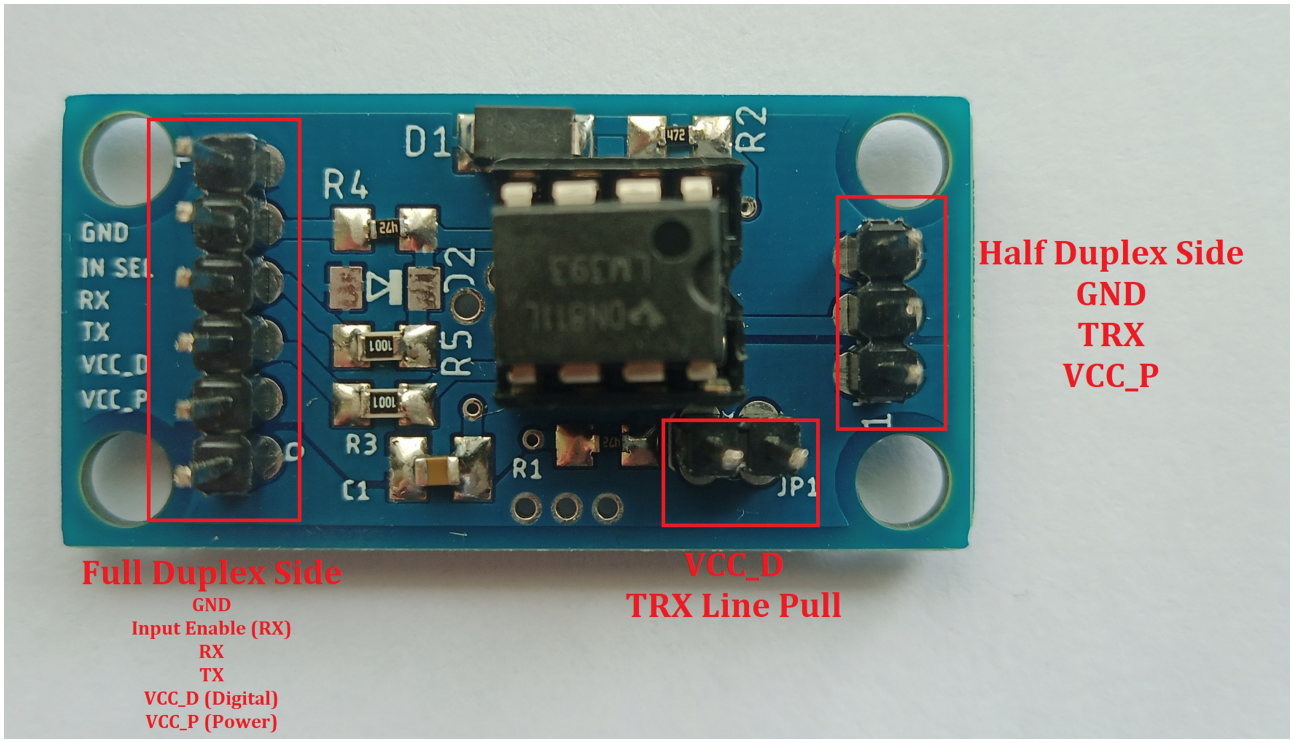
Raging Bits Full Duplex to Half Duplex converter v1.1

Top level specs

Up to 1mbit speed.
Maximum of 200ns propagation delay.
Level shifter high to low, low to high.
3.3V to 12V (Digital).
Power line bypass up to 25V 5A





Device interface

Full duplex side:

GND - Power ground.

IN SEL – This pin powers the pull up of the RX pin. The RX signal will be an output with an amplitude voltage of the IN SEL pin fed voltage.

RX – Full duplex data input. This pin will output the TRX pin data signal, with a voltage amplitude given by IN SEL pin. It can also work as an open drain if IN SEL is not powered.

TX – Full duplex data output. This pin will drive the TRX pin data signal. If the RX pin is active or being use, the RX pin will output the TX signal.

VCC_D – Power input for the digital hardware. From 3.3V to 12V, will power both the hardware and the TRX signal line voltage, if the PULL UP jumper is connected.

VCC_P – Power voltage bypass.

Half duplex:

GND – Power ground.

TRX – Half Duplex data input/output. This pin signal voltage is same as VCC_D if the network uses the device as signal voltage amplitude source by means of the PULL UP jumper.

VCC_P – Power voltage bypass.

TRX Pull:

This jumper enables a **4.7 kohm** resitor pull from VCC_D.

PIN RATINGS

VCC_D – Minimum 3.3V, maximum 12V.

VCC_P – Maximum 25V 2A.

TRX – Will have a signal voltage of GND to VCC with a maximum current of **20mA**.

TX – Minimum 3.3V, maximum 12V.

IN SEL – Maximum 12V.

RX – Will have a signal voltage amplitude of GND to IN SEL Voltage.

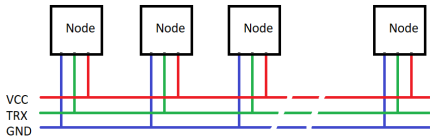
The TRX pin is a simple open drain design that can drive a very maximum of 20mA to the GND. The user can adjust the network setup pulls by using jumpers in the modules, to enable the VCC_D pull.

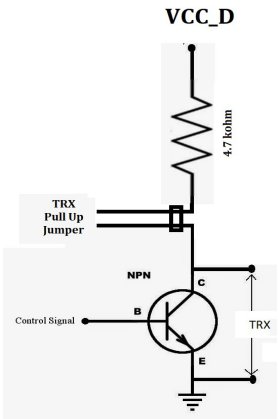
If multiple devices have enabled pulls, the total current equal to the sum of all the enabled pull voltages.

For example, is a network has 10 devices, with a VCC_D of 12V and only the first and last devices of the network have enabled pulls, then the total current used by one device TRX pin while signalling a 'zero' will be of 12V / (4700||4700) = 12/2400 = 0.0051A, aprox 5mA.
If 3 devices had the pulls enabled, then 12V / (4700||4700||4700) = 12/1600 = 0.0075A, aprox 8mA, and so on and so forth.

WORK

Networking:
The device can be used as a half duplex network of multiple device nodes.
The TRX is driven using a pseudo IO that consists in a **4.7 Kohm** resistor pulled by an open drain pin.





The maximum current through TRX is 20mA.
This means that the higher the VCC_D, the less nodes with pull enabled are supported in the network, given that at any time any node sets TRX to zero, all the nodes pull resistors are being pulled to the ground simultaneously. (This also means the more nodes, the higher speeds are possible although have not been fully tested).

Notes

!!!ATTTENTION!!!

Never power TRX directly, as this pin works in open drain with a maximum current of 20mA, it would lead to a direct short circuit to GND destroying the device immediately.

Always make sure of all the connections before powering the device.

Although this depends of the user and application conditions, its possible that the device gets damaged at some point, and stops working properly. There is a very high chance that the damage is to the LM393 (simple dual comparator), simply replace it with a new one paying attention to the polarity placement.

Examples:

Signal shape comparing 1 node and 2 nodes:

Illustration 1: Signal shape input(yellow) to output(blue) with 1 Node@1Mbps

Illustration 2: Signal shape input(yellow) to output(blue) with 2 Nodes@1Mbps

Signal propagation delay:

Illustration 3: Signal delay RX(yellow) given a TRX(blue) with 2 Node@1Mbps