I2C SPI GPIO UART IoT Card

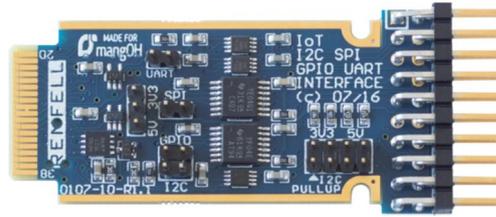P/N: 0107-10-R1.1

Release 1.0 2016.12.01

Renfell Engineering Pty Ltd

I2C SPI GPIO UART Interface

mangOH™ Internet of Things card

Introduction

The Renfell Engineering Interface IoT card enables the developer to access some of the I/O interfaces of the mangOH™ development board without having to design a custom card.

The I^{2}C, SPI, GPIO and UART interfaces on the mangOH™ IoT slot connector are brought out to the 'outside world' on a 20 pin 0.1" pitch connector via isolation and level shifting circuitry. Devices connected to the 'outside' can be powered from either the mangOH™ supplied 3V3 or 5V supplies, or via 2V8 to 5V0 supplies on the 20pin connector.

All I/O is disabled by default and each interface can be separately enabled using the on-board jumpers. Additionally, a header block is provided with standard I^{2}C pullups for 3V3 or 5V operation.

64 Bytes of user Read/Write EEPROM storage is provided for storage of configuration constants or other semi-permanent data.

Important Notice

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mangOH™, Legato™ and the mangOH™ symbol are Registered Trademarks® of Sierra Wireless, Inc and are used with permission. All other product and company names are trademarks™ or registered® trademarks of their respective holders. Use of them does not imply any affiliation with or endorsement by the respective trademark owners

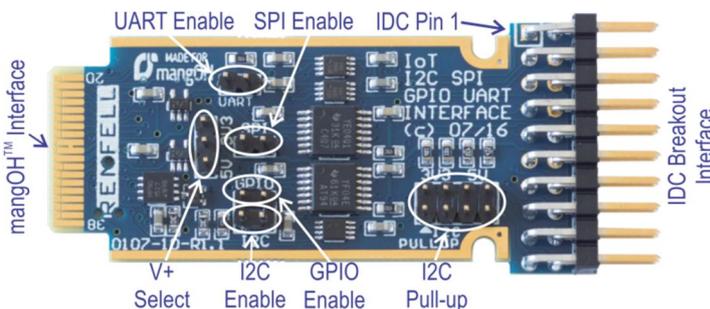## Table of contents
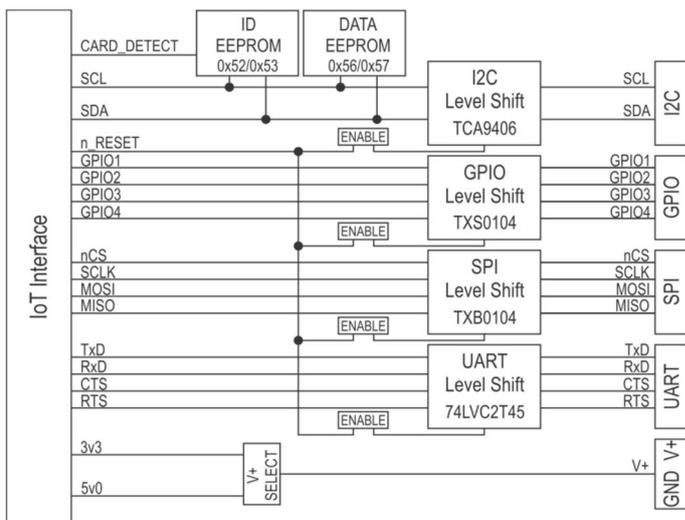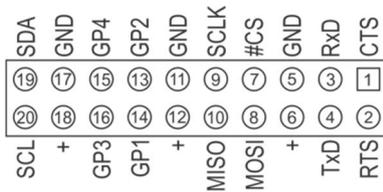
Board Overview

Block Diagram

Connection Details

Connection to the IoT card is via an 0.1" male IDC-20 header.

IDC-20 connection

looking INTO IoT Card

Signal Name	Direction with respect to IoT Card	IDC-20 Pin No	Description
CTS	Out	1	UART 'Clear to Send'
RTS	In	2	UART 'Request to Send'
RxD	Out	3	UART 'Receive Data'
TxD	In	4	UART 'Transmit Data'
GND		5	Common Ground
+		6	Common Supply V+
#CS	Out	7	SPI 'Chip Select' (Active LOW)
MOSI	Out	8	SPI 'Master Out Slave In'
SCLK	Out	9	SPI 'Serial Clock'
MISO	In	10	SPI 'Master In Slave Out'
GND		11	Common Ground
+		12	Common Supply V+
GP2	Bi-Dir	13	GPIO 2
GP1	Bi-Dir	14	GPIO 1
GP4	Bi-Dir	15	GPIO 4
GP3	Bi-Dir	16	GPIO 3
GND		17	Common Ground
+		18	Common Supply V+
SDA	Bi-Dir	19	I^{2}C 'Serial Data'
SCL	Out	20	I^{2}C 'Serial Clock'

Common Supply

V+ is the 'high-side' level shifting voltage and can range between 2V8 and 5V2. V+ can be sourced either from the mangOH^{TM} IoT interface (fixed at 3V3 or 5V0), or externally via the IDC-20 connector.

GND is a common ground between the mangOH^{TM} board, the IoT board and any devices connected to the IDC-20 connector.

> **WARNING:** There is no reverse polarity or overvoltage/overcurrent protection on the common supply connections. Connecting an external supply while having the V+ select connected to the mangOH^{TM} WILL cause damage to the mangOH^{TM} board.

All V+ and GND pins are common.

UART

Four UART signals are brought out to the IDC-20 connector

> TxD
> RxD
> RTS
> CTS

These signals are at the same voltage level as V+, are TTL sense and they require a MAX232 or equivalent line driver to convert the signal levels to true RS232 signal levels.

The UART interface signals are named as for a Data Communications Equipment (DCE) interface.

SPI

Four SPI signals are brought out to the IDC-20 connector

> nCS
> SCLK
> MOSI
> MISO

The SPI signals are level shifted via a Texas Instruments TXB0104 4-bit Bidirectional Voltage-level Translator.

Note that the SPI interface on the mangOH^{TM} board is a Master interface only. If a slave interface is required, it is up to the end user to configure a GPIO pin as an interrupt (or other alerting method) so that the mangOH^{TM} can poll the slave device.

GPIO

All four GPIO signals are brought out from the mangOH^{TM} interface and level shifted via a Texas Instruments TXS0104 4-bit Bidirectional Voltage-level Translator. The TXS0104 has automatic direction sensing, so the user does not have be concerned about setting the direction (IN or OUT) of individual pins on the IoT Interface board.

I²C

The SDA and SCL I²C signals are level shifted via a dedicated Texas Instruments TCA9406 2-Bit Bidirectional I²C Bus Voltage-level Translator.

I²C pull-up resistors optimised for 3V3 and 5V0 can be connected to the level shifted side of the I²C bus via the 2mm headers provided.

Data EEPROM

64 bytes of Read-Write EEPROM storage is provided on the IoT card. This EEPROM is located on the I2C bus at address 0x56 or 0x57 (depending on state of the CARD_DETECT signal), and consists of two 32 byte pages. The EEPROM is always available – regardless of the state of the IoT interface nRESET signal.

Read and Write operations are as per the Microchip 24AA32A EEPROM. In particular the following caveats should be noted:

1. Only 64 bytes of data are available starting at address 0x00.
2. Reads outside the valid address space of 0x00 – 0x3F will always return 0xFF
3. Writes outside the valid address space of 0x00 – 0x3F will fail silently
4. Writes are done in a maximum of 32 byte pages. If the starting address of the write is not on a page boundary, the write will 'wrap around' at the page boundary and overwrite data at the beginning of the page.
5. Reads can be of any size and start from any address – but note point (2) above.
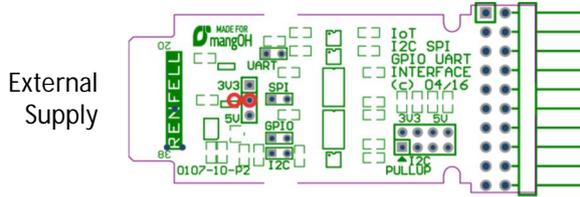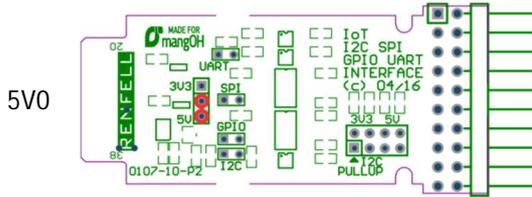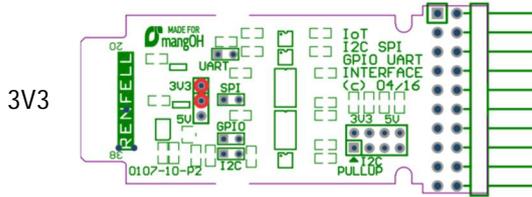
Configuration

Before using the interfaces on this IoT card, all jumpers must be configured appropriately. Additionally, the IoT slot on the mangOH™ board **MUST** be enabled to allow the nRESET signal to enable the level shifting circuitry on the card.
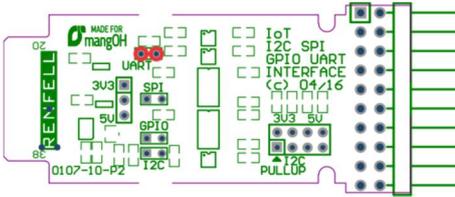
> WARNING: There is no reverse polarity or overvoltage/overcurrent protection on the common supply connections. Connecting an external supply while having the V+ select connected to the mangOH™ WILL cause damage to the mangOH™ board.

> ATTENTION: The nRESET signal MUST be asserted (i.e. not set) in software before any of the interfaces will be enabled on the IoT card.
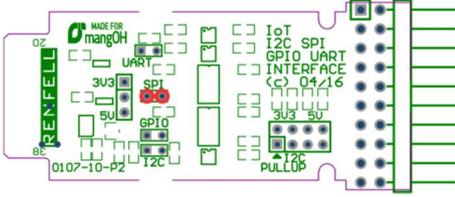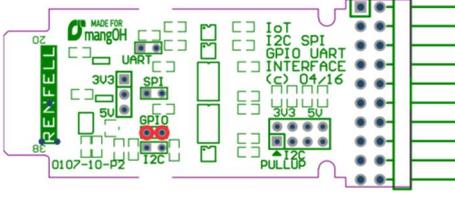
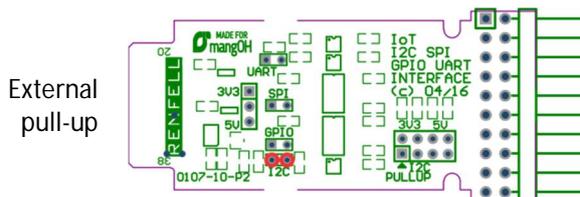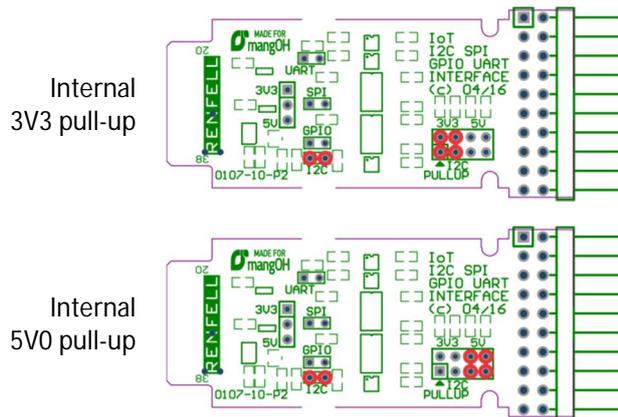*Renfell Engineering Pty Ltd*

Power

3V3

5V0

External Supply

UART

SPI

GPIO

I²C

External pull-up

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Internal 3V3 pull-up

Internal 5V0 pull-up

References

- Latest product information: http://www.renfell.com/mangOH/index.html
- mangOH^{TM} and Legato Tips, Articles and Tutorials:
  https://www.littlesliceofmangoh.com
- Legato information: http://legato.io
- mangOH^{TM} information: http://mangoh.io
- Microchip 24AA32A: http://www.microchip.com/24AA32A
- Texas Instruments TXB0104: http://www.ti.com/product/TXB0104
- Texas Instruments TXS0104: http://www.ti.com/product/TXS0104E
- Texas Instruments TCA9406: http://www.ti.com/product/TCA9406