
OneWire

OneWire: general ideas

OneWire, or "w1", is a low-speed bus for short distances

- More like I2C or SPI than USB
- It supports longer distances than I2C, but a much lower data rate

Designed by Dallas Semiconductors (now part of Maxim)

- No other vendor, so far (patent-related?)
- You can buy thermometers, eeproms, and MAC addresses.

W1 is actually two wires, or three

- Ground
- The data line
- Optionally, a power supply

You usually can drive it from GPIO lines

- Some vendors offer a logic cell in the SoC

W1: Electrical

A shared line has a dominant and a recessive state

- Here, as usual, high is recessive and low is dominant
- Both the master and the slave can pulse the line low

The signal line is also a power line

- The slaves feature an internal capacitor and low consumption
- But extra power may be needed during conversion
- As a result you either need two wires in the device, or in the uC
- The below figures are from the DS18B20 data sheet

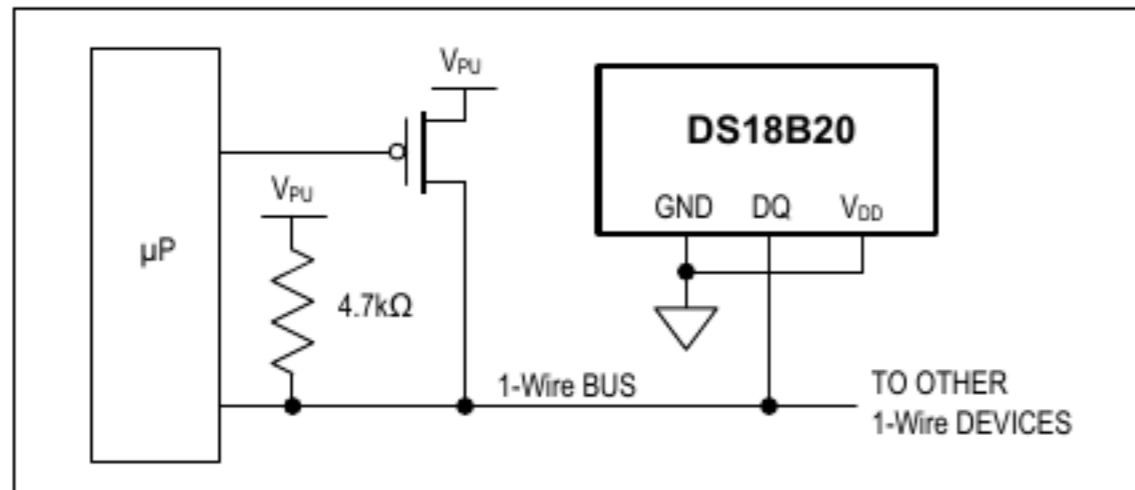


Figure 6. Supplying the Parasite-Powered DS18B20 During Temperature Conversions

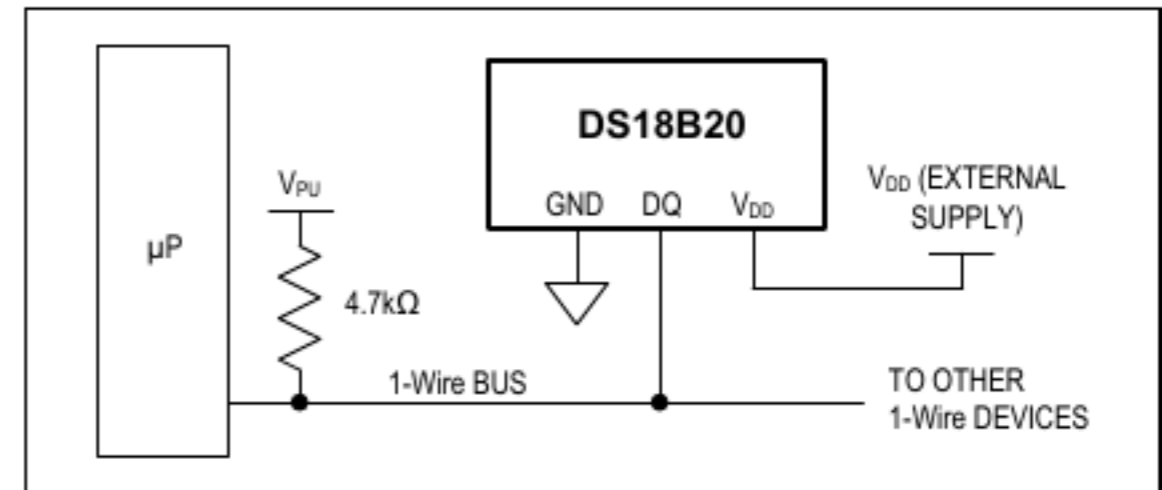


Figure 7. Powering the DS18B20 with an External Supply

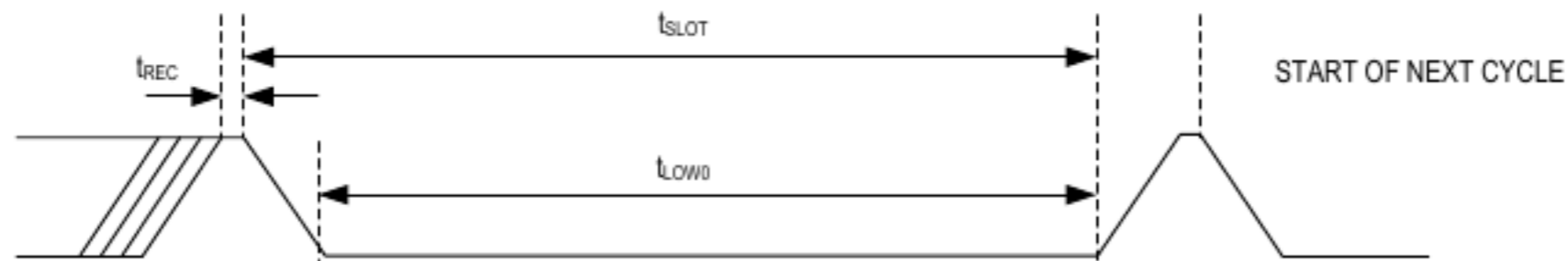
W1: Timing

Communication happens through low pulses:

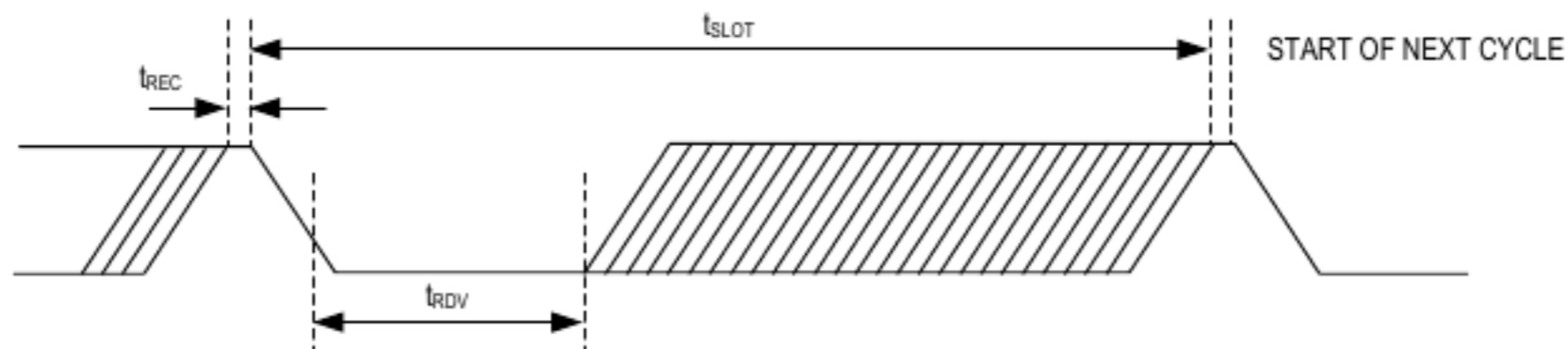
- A long pulse is write-0 (it reads as 0 after a delay): 60 - 120 us
- A short pulse is write-1 (it reads as 1 after a delay): 1 - 15 us
- A short pulse can also be used to read a bit
 - ♦ The slave will make the pulse longer, or not.

An initial long pulse is used to reset the bus (480us or more)

1-WIRE WRITE ZERO TIME SLOT



1-WIRE READ ZERO TIME SLOT



W1: Addressing

Each device features a 64-bit unique identifier

- LSB: class code (device type)
- 48 bits of serial number
- MSB: crc8

Most communication is addressed to a specific device

- After reset, you can send the "match rom" command
- Then, any command is for the specific device

Broadcast is supported too

- After reset, you send the "skip rom" command
- Subsequent commands will be accepted by all devices

When you connect more than one device, bandwidth suffers

- Addressing one device takes almost 10ms
 - ◆ 480us for reset, plus ack etc
 - ◆ 120us * 72 for the address
 - ◆ And then you can communicate

W1: Enumeration

At system boot, you may need to enumerate your bus

- You can skip this step if you feature a single device

The "search rom" command is designed to resolve conflicts:

- The master writes the command
- It reads back one bit and the negation of the bit
- It then writes the bit it wants to select

If you read two zeroes, there is a conflict ("discrepancy")

- You can choose which branch you follow and come back later
- See AN187 for a good description and a ugly implementation

This enumeration takes 10-20ms for each device

- Fortunately, you do it once per boot.

W1: Geographical

The is usually no way to identify bus geometry

- If you have several sensors, you can't know which is which
- Thus, you usually only feature one device, or one per type
 - ♦ You can have one thermometer and one EEPROM
 - ♦ But I2C or SPI storage is much cheaper

Some devices offer extra pins to specify an "address"

- You connect these to low or high level
- The device status register is returning the value

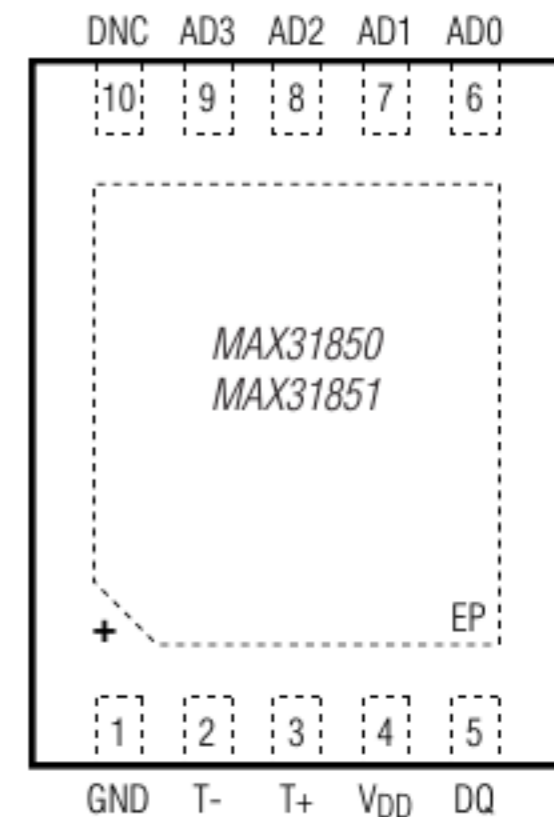
In this case, you can match devices to their position

- 1 wire but many pins

Once I placed 20 of them in a board

- 4 gpio lines in total

TOP VIEW



TDFN-EP
(3mm x 4mm)

W1: Summary

A great idea, but not really much used

- They make sense only for remote thermometers in a noisy environment
- Or as "smart" keys in their "button" mechanical case

W1 thermometers are very expensive

- More than 1 EUR, compared to 3-7 cents
- And they can't even be deployed in strings (geographical issue)

The sequential serial number is a useful resource

- You can use the LSB to create your own MAC address
- Please use the "locally assigned" address space
- But if your uC has a serial number, you can use that one

You can even find "MAC address" devices

- The address a real IEEE-blessed MAC address
- 2 EUR each if you get 1000 of them!!

A niche market, for rich makers