Definitions

Master: Device which controls the bus
Slave: Device which is addressed by a master
R_{PU}: Pull-up resistance
SDA: Serial Data Line
SCL: Serial Clock Line
Transmitter: A device that transmits data onto the I2C Bus
Receiver: A device that receives data from the I2C Bus
Arbitration: Process to determine which master can control the bus when more than one Master exists

Switching I2C Buses

Key Concept: Useful for addressing multiple slaves which might have overlapping I2C addresses, or if you wish to disconnect a part of a bus for a given operation.

Devices: TCA9517, TCA9517B, P82B715

Extending I2C Buses

Key Concept: Capacitance must be split in order to keep capacitance on a single line below 400 pF.

Devices: TCA9543A, TCA9544A, TCA9546A, TCA9545A, TCA9548A

Useful Tips

\[ R_{PU}(\text{min}) = \frac{(V_{cc} - V_{OL})}{I_{OL}} \]
\[ R_{PU}(\text{max}) = \frac{t_{r}}{0.8473 \times C_b(\text{SDA/SCL})} \]

Measuring \( C_b \): Good assumption to make it \( \sim 15 \) pF per device added on the bus

Max Pull-Up Resistance vs Bus Capacitance

Basic Setup

GPIO Expansion with I2C

Key Concept: Useful for providing additional GPIOs by using I2C bus.

Devices: TCA9554, TCA9534, TCA9539, TCA6408A, TCA6416A

Symbol | Parameter | Standard Mode Min/Max | Fast Mode Min/Max
--- | --- | --- | ---
\( V_{IL} \) (V) | Low-level input voltage | -0.5 / 0.3V_{CC} | -0.5 / 0.3V_{CC}
\( V_{IH} \) (V) | High-Level input voltage | 0.7V_{CC}/V_{CCMAX}+0.05 | 0.7V_{CC}/V_{CCMAX}+0.05
\( V_{OL} \) (V) | Low-level output voltage \( V_{CC}>2V \) | 0 / 0.4 | 0 / 0.4
\( V_{OHL} \) (V) | Low-level output voltage \( V_{CC}\leq2V \) | - / - | 0 / 0.2V_{DD}
\( I_{OL} \) (mA) | Low-level ouput current \( V_{IL} = 0.4V \) | 3 / - | 3 / -
\( I_{OL} \) (mA) | Low-level ouput current \( V_{IL} = 0.6V \) | - / - | 6 / -
\( f_{SCL} \) (kHz) | SCL clock frequency | 0 / 100 | 0 / 400
\( t_{R} \) (ns) | Rise time for SDA/SCL | - / 1000 | 20 / 300
\( t_{F} \) (ns) | Fall time for SDA/SCL | - / 300 | 20 x (V_{CC}/5.5V) / 300
Simplify System Management and Control Designs
Wide range of I²C & SMBus functions with flexible voltages and channel count options

**Repeater**
- Static offset buffer
- Hot-swappable buffer
- Bus extender
- Level-shifter

**IO expanders**
- 4-, 8-, 16-, 24-bit
- Level-shifting expanders
- Open drain, push-pull IOs

**Switches**
- 1:2, 1:4, 1:8
- Level-shifting switches
- Interrupt switching

**Special function**
- LED driver
- Keyboard scanner

**Key Products**
- PCA9306
- TCA9617A
- P82B96
- TCA6408A
- TCA6416A
- TCA6424A
- TCA9548A
- TCA9546A
- TCA9543A
- TCA8418E
- TCA8424
- TCA6507

**Target Applications and end equipment:**
- Switches
- Base Stations
- Control Panels
- Servers
- Medical Imaging
- Sensing
- Remote Controls
- HMI
- Automotive
- Set Top Box
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