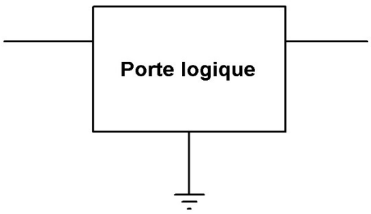
Structure adaptatrice de niveaux de tension = level shifter

- Prendre connaissance du document « **Terminologie des CI numériques** ».

- Compléter la représentation ci-contre :



- Exemple : peut-on associer directement un microcontrôleur ATMEGA 328P alimenté sous 5V (Arduino Uno) et un capteur de température et d'humidité relative Si7021? *Extraits des documentations pages 3 et 4.*

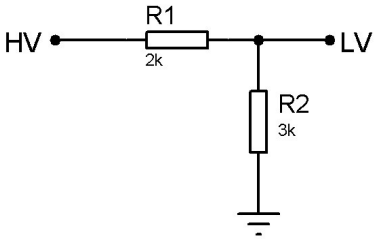
→

- Quel est l'intérêt d'effectuer une adaptation de 5V vers 3,3V ? →

- Quel est l'intérêt d'effectuer une adaptation de 3,3V vers 5V ? →

- Regarder les vidéos de Kevin Darrah et de Eric Peronnin, elles sont complémentaires.

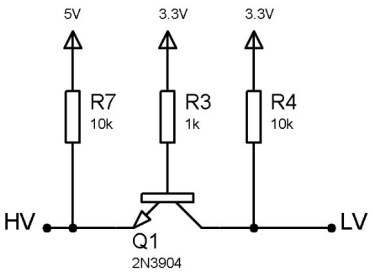
1ère solution proposée : pont diviseur de tension



- Avantage :

- Inconvénient :

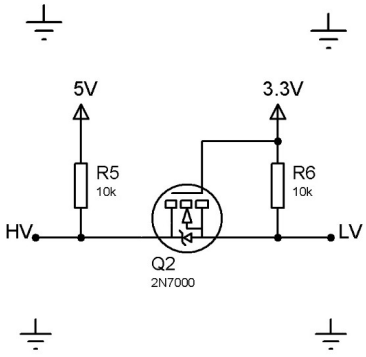
2nde solution proposée : transistor NPN



- Avantage :

- Inconvénient :

3ème solution proposée : transistor MOS



- Avantage :

Des transistors autres que le 2N7000 peuvent-ils convenir ?

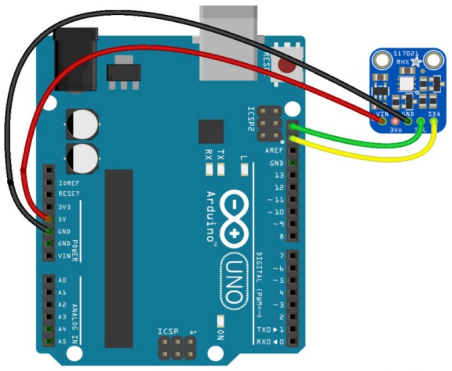
→

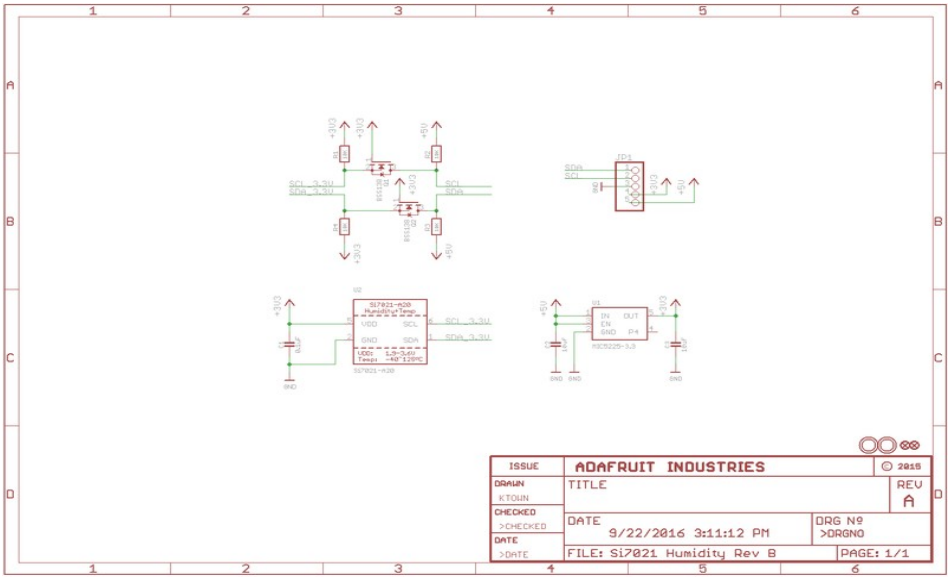
Certains breakout intègrent un level shifter, d'autres pas.

Exemple du capteur si7021 qui fait l'objet d'un breakout chez 2 fabricants différents.

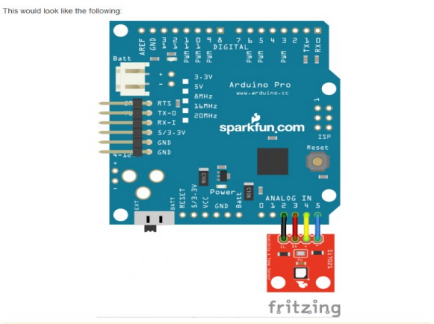
- Entourer la structure adaptatrice de niveaux, si elle existe, sur chaque schéma.
- Quelle est la spécificité de la seconde structure ? →

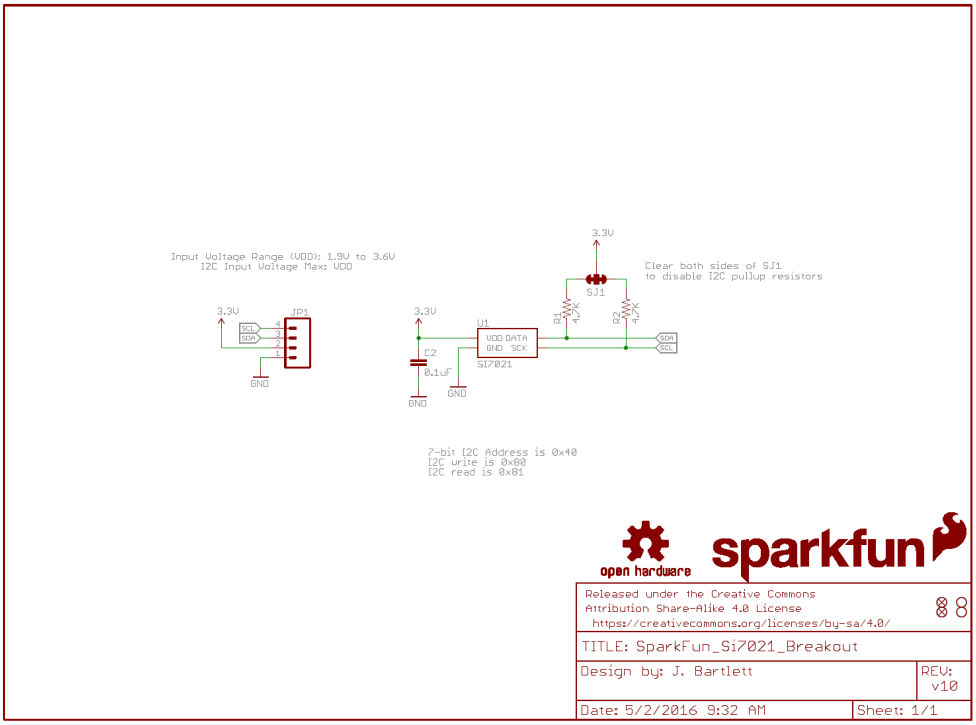
Breakout Adafruit :





Breakout Sparkfun :





30. Electrical Characteristics (T_A = -40°C to 105°C)

30.1 Absolute Maximum Ratings*

Operating Temperature	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Voltage on any Pin except $\overline{\text{RESET}}$ with respect to Ground	-0.5V to V_{CC}+0.5V
Voltage on $\overline{\text{RESET}}$ with respect to Ground	-0.5V to +13.0V
Maximum Operating Voltage	6.0V
DC Current per I/O Pin	40.0mA
DC Current V_{CC} and GND Pins	200.0mA

*NOTICE: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

30.2 DC Characteristics

Table 30-1. Common DC characteristics T_A = -40°C to 105°C, V_{CC} = 1.8V to 5.5V (unless otherwise noted)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
V_{IL}	Input Low Voltage, except XTAL1 and $\overline{\text{RESET}}$ pin	V_{CC} = 1.8V - 2.4V V_{CC} = 2.4V - 5.5V	-0.5 -0.5		$0.2V_{CC}$ (1) $0.3V_{CC}$ (1)	V
V_{IH}	Input High Voltage, except XTAL1 and $\overline{\text{RESET}}$ pins	V_{CC} = 1.8V - 2.4V V_{CC} = 2.4V - 5.5V	$0.7V_{CC}$ (2) $0.6V_{CC}$ (2)		V_{CC} + 0.5 V_{CC} + 0.5	V

Table 30-1. Common DC characteristics T_A = -40°C to 105°C, V_{CC} = 1.8V to 5.5V (unless otherwise noted) (Continued)

Symbol	Parameter	Condition		Min.	Typ.	Max.	Units
V_{OH}	Output High Voltage(3) except Reset pin	I_{OH} = -20mA, V_{CC} = 5V	T_A=85°C	4.2			
			T_A=105°C	4.1			
		I_{OH} = -10mA, V_{CC} = 3V	T_A=85°C	2.3			
			T_A=105°C	2.1			V
V_{OL}	Output Low Voltage(4) except RESET pin	I_{OL} = 20mA, V_{CC} = 5V	T_A=85°C			0.9	
			T_A=105°C			1.0	
		I_{OL} = 10mA, V_{CC} = 3V	T_A=85°C			0.6	
			T_A=105°C			0.7	V

Si7021-A20

I²C HUMIDITY AND TEMPERATURE SENSOR

Features

- Precision Relative Humidity Sensor
  - ± 3% RH (max), 0–80% RH
- High Accuracy Temperature Sensor
  - ±0.4 °C (max), –10 to 85 °C
- 0 to 100% RH operating range
- Up to –40 to +125 °C operating range
- Wide operating voltage (1.9 to 3.6 V)
- Low Power Consumption
  - 150 µA active current
  - 60 nA standby current
- Factory-calibrated
- I²C Interface
- Integrated on-chip heater
- 3x3 mm DFN Package
- Excellent long term stability
- Optional factory-installed cover
  - Low-profile
  - Protection during reflow
  - Excludes liquids and particulates

Ordering Information:
See page 29.

1. Electrical Specifications

Unless otherwise specified, all min/max specifications apply over the recommended operating conditions.

Table 1. Recommended Operating Conditions

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Power Supply	V_{DD}		1.9	—	3.6	V
Operating Temperature	T_A	I and Y grade	–40	—	+125	°C
Operating Temperature	T_A	G grade	–40	—	+85	°C

Table 2. General Specifications

1.9 ≤ V_{DD} ≤ 3.6 V; T_A = –40 to 85 °C (G grade) or –40 to 125 °C (I/Y grade); default conversion time unless otherwise noted.

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Input Voltage High	V_{IH}	SCL, SDA pins	0.7xV_{DD}	—	—	V
Input Voltage Low	V_{IL}	SCL, SDA pins	—	—	0.3xV_{DD}	V
Input Voltage Range	V_{IN}	SCL, SDA pins with respect to GND	0.0	—	V_{DD}	V
Input Leakage	I_{IL}	SCL, SDA pins	—	—	1	µA
Output Voltage Low	V_{OL}	SDA pin; I_{OL} = 2.5 mA; V_{DD} = 3.3 V	—	—	0.6	V
		SDA pin; I_{OL} = 1.2 mA; V_{DD} = 1.9 V	—	—	0.4	V

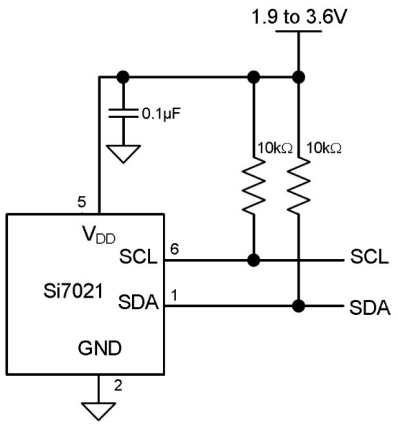


Figure 4. Typical Application Circuit for Relative Humidity and Temperature Measurement