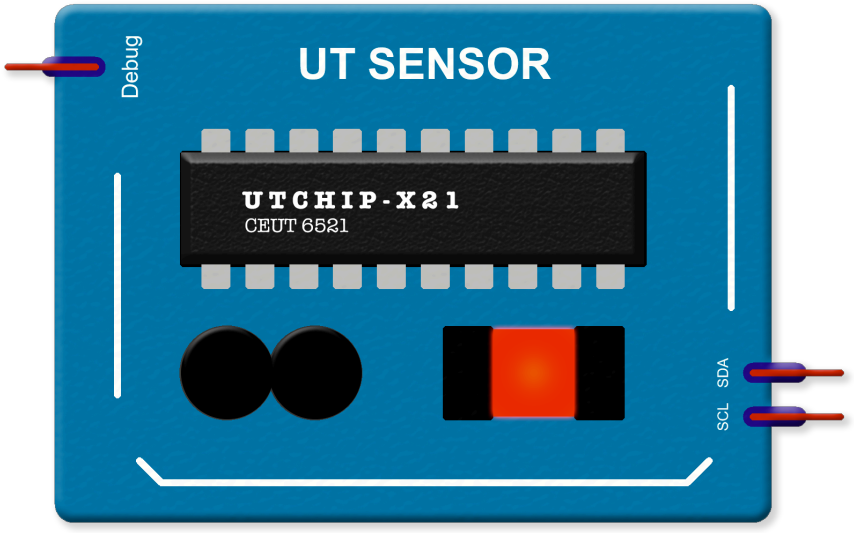
UT Sensor v1.1.0

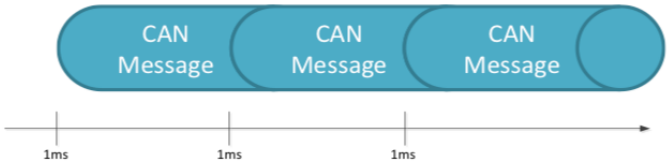
University of Tehran

UT Sensor Data Sheet

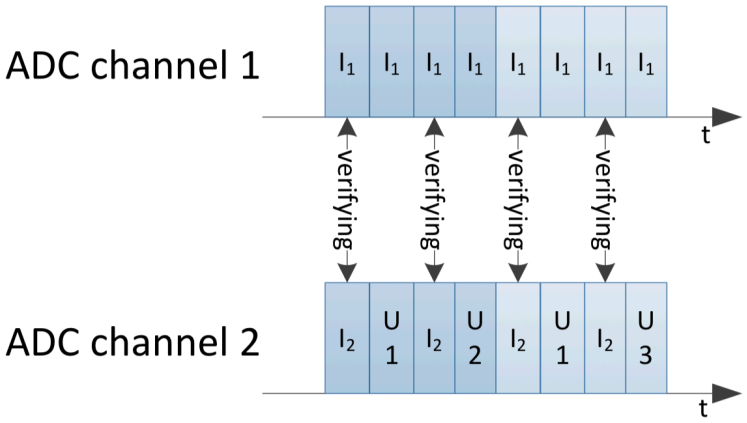


1. Sampling Rate

Current measurement characteristics:
One ADC channel is only used for the current measurement, with a provided maximum output rate of one message per 1ms.



Behavior ADC channel 1 and 2



After every channel sampling, the current channel is additionally sampled for internal use (verifying current measurement for internal safety).

Voltage measurement characteristics
The second ADC (ADC2) channel is used for voltage measurement. This channel is used for different signals, which are multiplexed.

2. Temperature calibration

Each measurement result can be influenced by shifting temperatures. For this reason, the IVT-S includes an internal temperature compensation to provide an optimized result in the complete defined temperature range.

3. Operation conditions

Parameter	min.	typ.	Max.	Unit
Operating temperature	-40		+105	°C
Storage temperature	-40		+125	°C
Supply voltage (V_{cc})	5.5	12	40	V
Current consumption		30	80	mA
Re-/ Startup time		350	400	ms
Waiting time power on/off	2			ms
Isolation	According to chapter 3.6			

4. Maximum Rating

Parameter	min.		Max.	Unit
Storage temperature	-40		+125	°C
Storage Humidity			95	%
Supply voltage	-42		42	V

5. Voltage measurement

Parameter				Unit
Nominal measurement range		±1000		V
Extended range (nonlinear)		±1200		V
Initial accuracy		0.1		% of reading
Total accuracy		0.5		% of reading
Offset		100		mV
Linearity		0.01		% of range
Noise[3]		60		mV (RMS)
Resolution		30		mV

6.1. I2C Interface

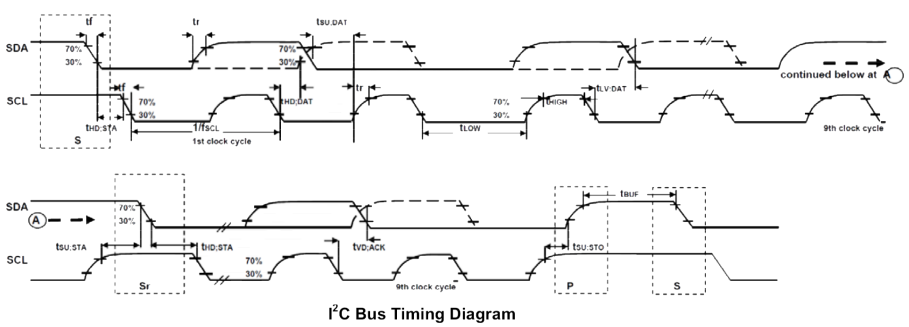
I2C is a two-wire interface comprised of the signals serial data (SDA) and serial clock (SCL). In general, the lines are open-drain and bi-directional. In a generalized I2C interface implementation, attached devices can be a master or a slave. The master device puts the slave address on the bus, and the slave device with the matching address acknowledges the master.
The UT Sensor always operates as a slave device when communicating to the system processor, which thus acts as the master. SDA and SCL lines typically need pull-up resistors to VDD. The maximum bus speed is 400 kHz. The slave address of the UT Sensor is b1101110 (d110) which is 7 bits long.

6.2. I2C Timing Characterization

6.7 I^2C Timing Characterization
Typical Operating Circuit of Section 7.2, VDD = 2.375V-3.46V, VLOGIC (MPU-6050 only) = 1.8V±5% or VDD, T_A = 25°C

Parameters	Conditions	Min	Typical	Max	Units	Notes
I^2C TIMING	**I^2C FAST-MODE**					
f_{SCL}, SCL Clock Frequency				400	kHz	
$t_{HD.STA}$, (Repeated) START Condition Hold Time		0.6			µs	
t_{LOW}, SCL Low Period		1.3			µs	
t_{HIGH}, SCL High Period		0.6			µs	
$t_{SU.STA}$, Repeated START Condition Setup Time		0.6			µs	
$t_{HD.DAT}$, SDA Data Hold Time		0			µs	
$t_{SU.DAT}$, SDA Data Setup Time		100			ns	
t_r, SDA and SCL Rise Time	C_b bus cap. from 10 to 400pF	20+0.1C_b		300	ns	
t_f, SDA and SCL Fall Time	C_b bus cap. from 10 to 400pF	20+0.1C_b		300	ns	
$t_{SU.STO}$, STOP Condition Setup Time		0.6			µs	
t_{BUF}, Bus Free Time Between STOP and START Condition		1.3			µs	
C_b, Capacitive Load for each Bus Line			< 400		pF	
$t_{VD.DAT}$, Data Valid Time				0.9	µs	
$t_{VD.ACK}$, Data Valid Acknowledge Time				0.9	µs	

Note: Timing Characteristics apply to both Primary and Auxiliary I^2C Bus



I^2C Bus Timing Diagram

6.3. Sensor Data Registers

The sensor data registers contain X and Y data. They are read-only registers, and are accessed via the serial interface. Data from these registers may be read anytime. However, the interrupt function may be used to determine when new data is available.

Register	Address
On-Off Register	0x0
X Data	0xa - 0xd
Y Data	0x28 - 0x2b

On-Off Register is a one-bit register which is used for turning on or turning off the module (1 for turning on and 0 for turning off). Also, X and Y registers hold two 32bit floats (float32) numbers that represent the main data.

7. PCB Design Guidelines

The Pad Diagram using a JEDEC type extension with solder rising on the outer edge is shown below. The Pad Dimensions Table shows pad sizing (mean dimensions) recommended for the UT Sensor product.

JEDEC type extension with solder rising on outer edge