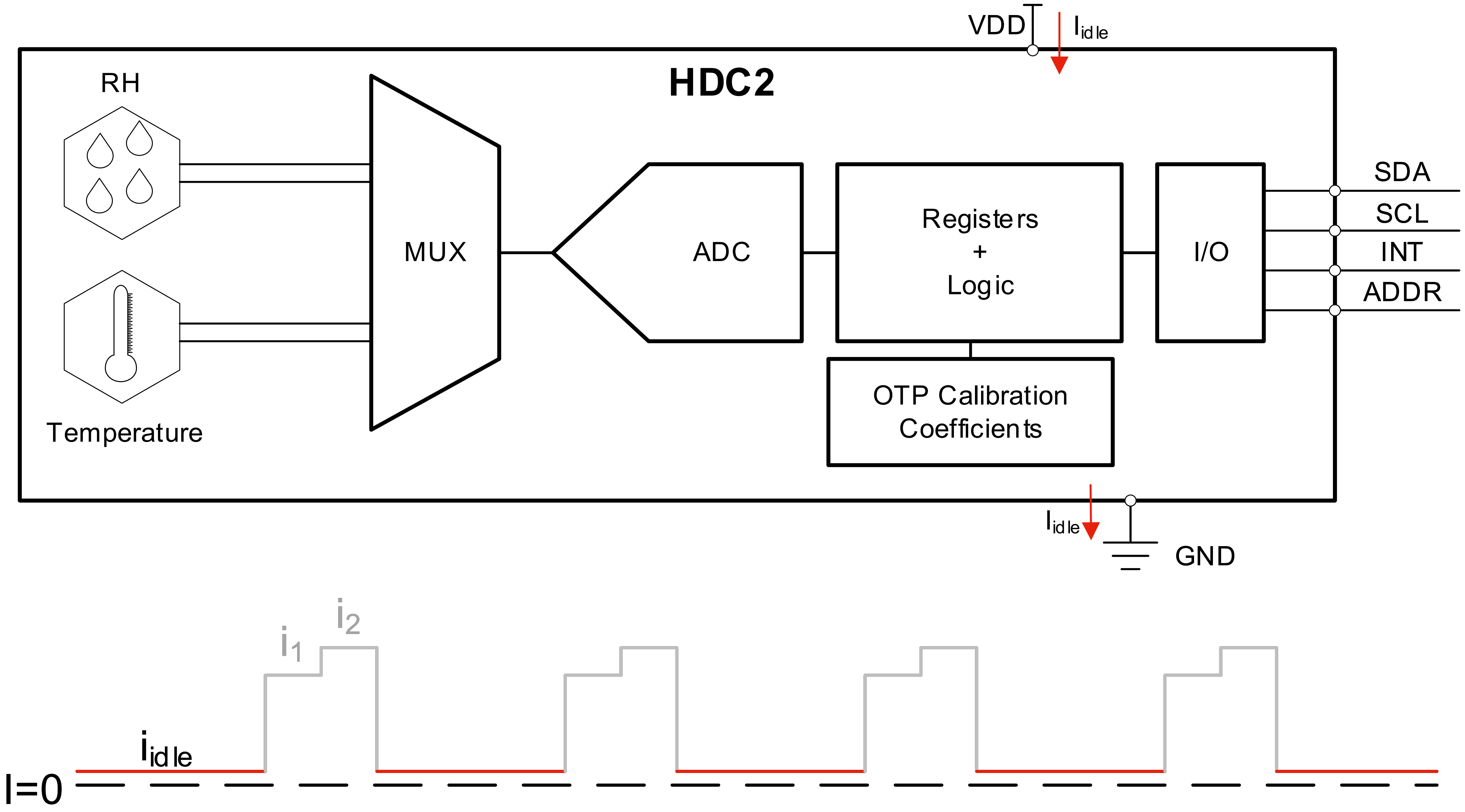
Humidity Sensor Power Consumption

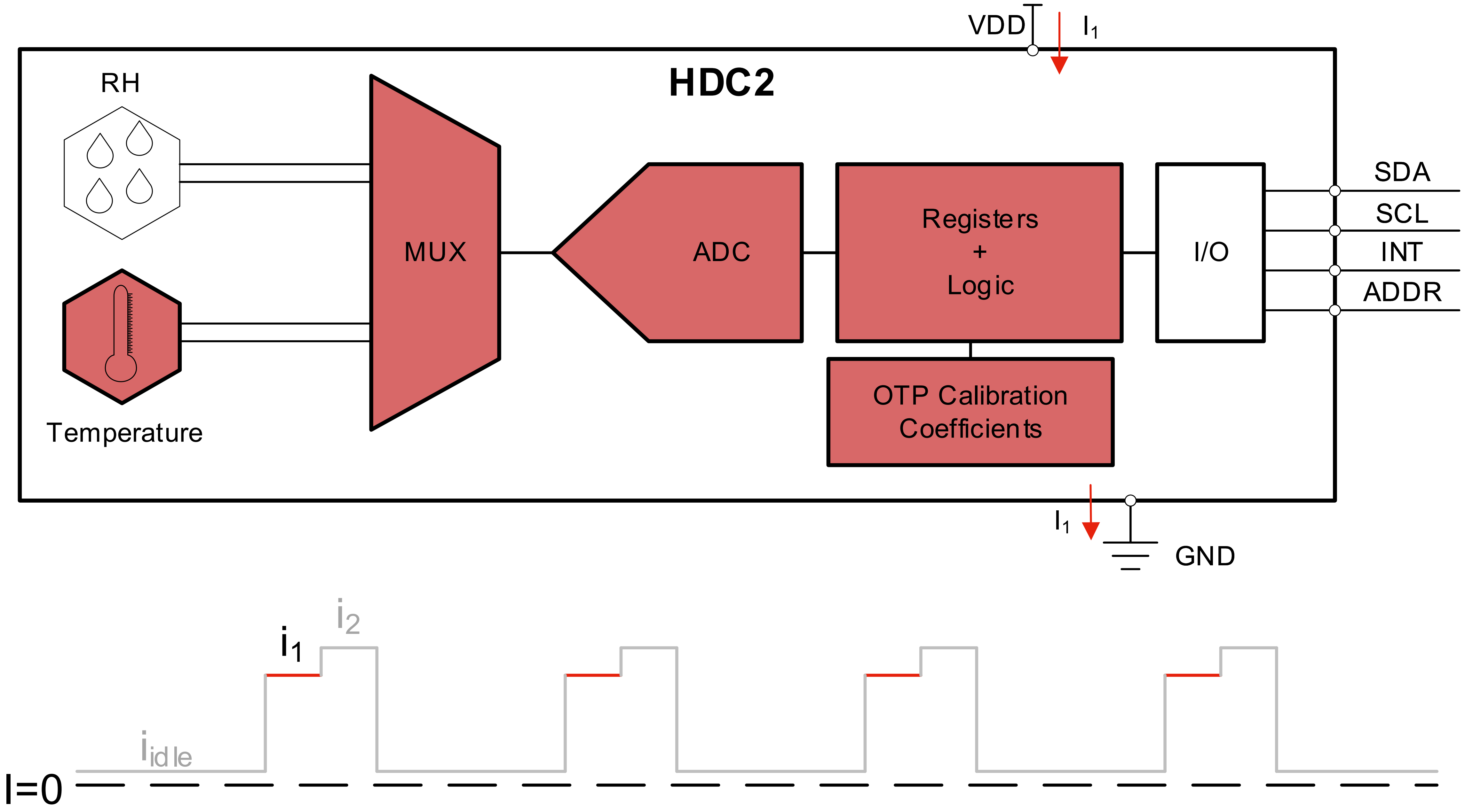
TI Precision Labs – Humidity Sensors

Presented and Prepared by Brandon Fisher

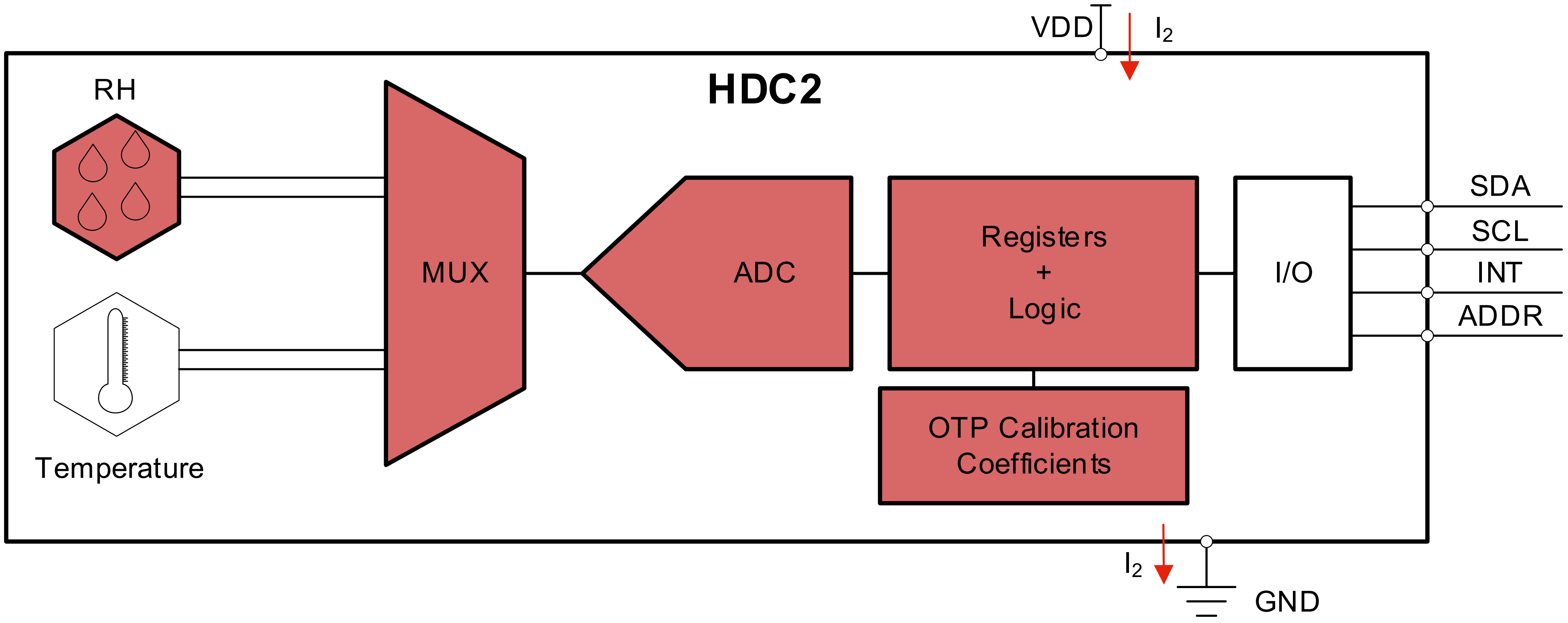
Power consumption in digital temperature sensors

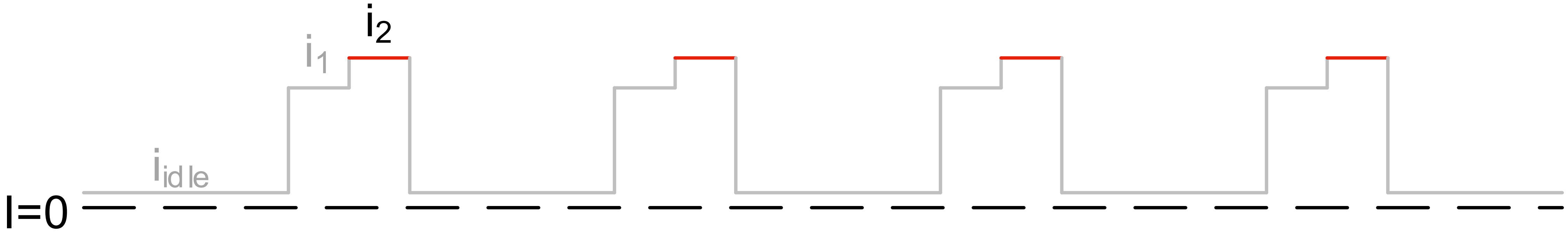


Power consumption in digital temperature sensors

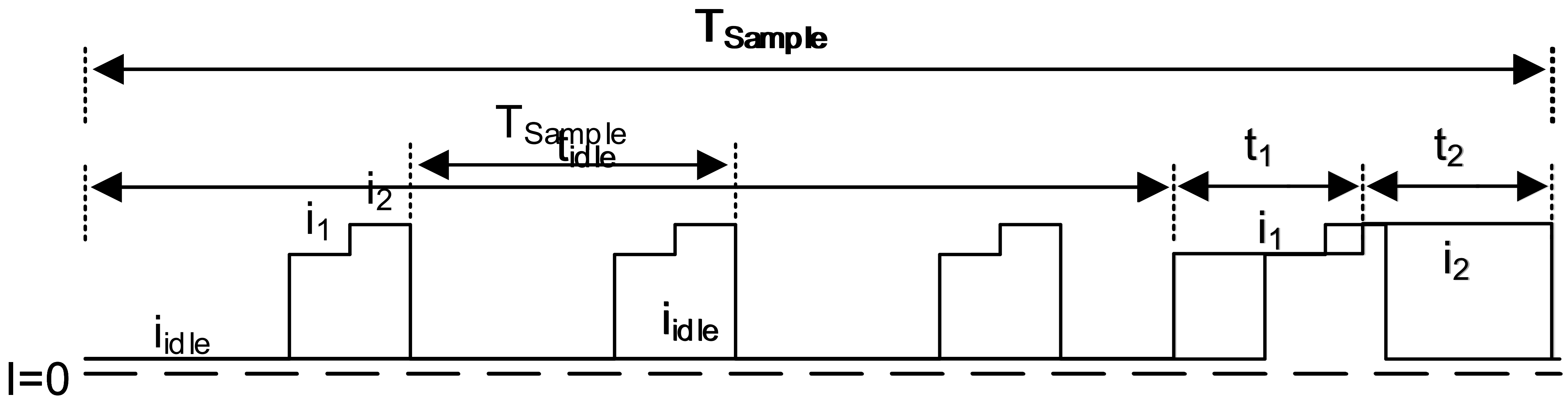


Power consumption in digital temperature sensors





Calculating sensor power consumption

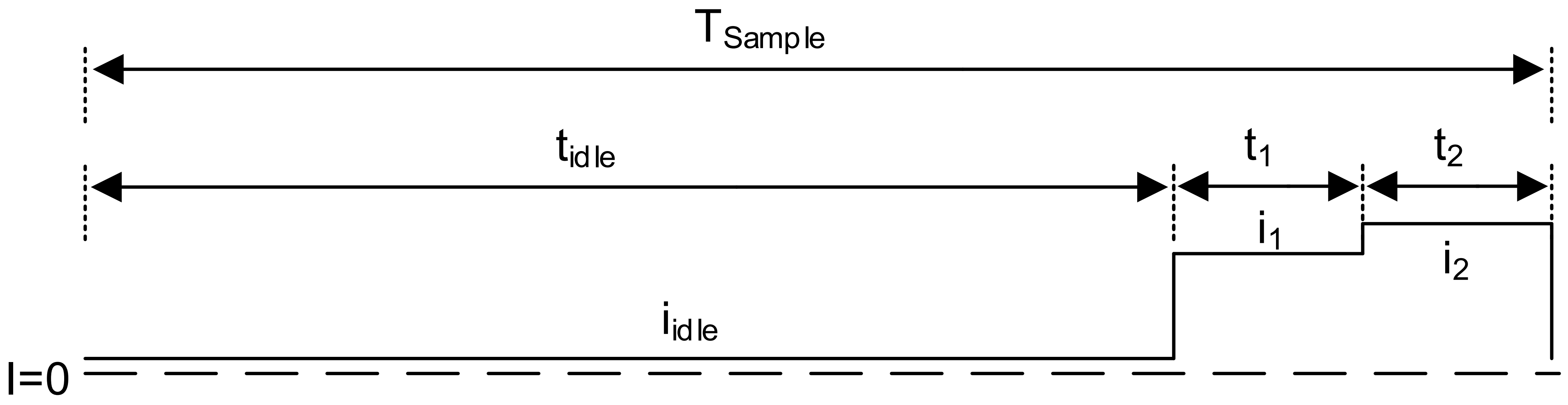


$$I_{AVG} = \frac{t_{idle} \times i_{idle} + t_1 \times i_1 + t_2 \times i_2}{T_{sample}}$$

$$t_{idle} = T_{sample} - (t_1 + t_2)$$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{DD}	Supply current	i_2 RH measurement(1)		650	890	µA
	i_1	Temperature measurement(1)		550	730	
	i_{idle}	Sleep Mode		0.05	0.1	
		Average at 1 measurement/second, RH or temperature only(1) (2)		0.3		
		Average at 1 measurement/second, RH (11 bit) + temperature (11 bit)(1) (2)		0.55		

Calculating sensor power consumption



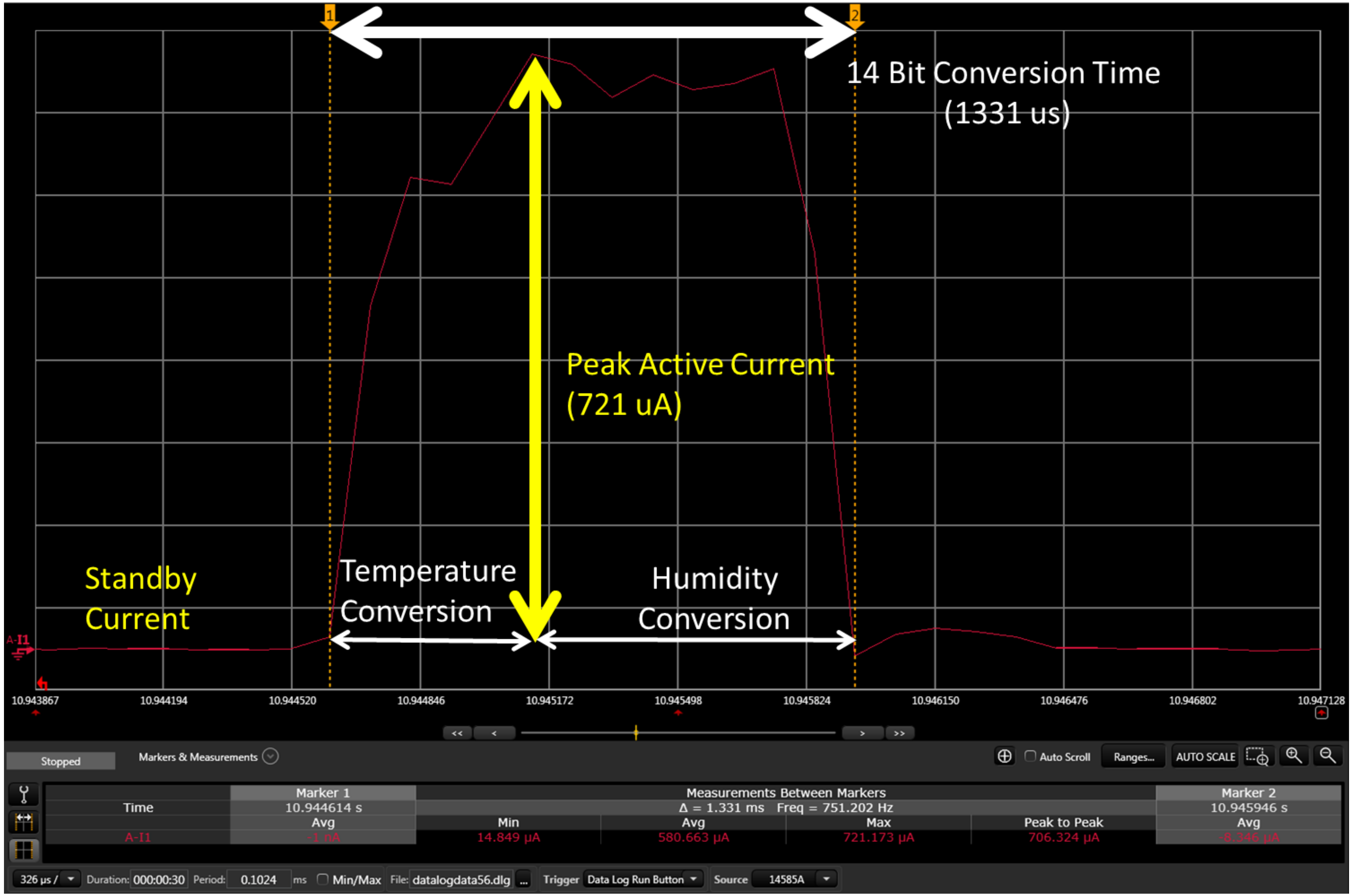
$$I_{AVG} = \frac{t_{idle} \times i_{idle} + t_1 \times i_1 + t_2 \times i_2}{T_{sample}}$$

$$t_{idle} = T_{sample} - (t_1 + t_2)$$

RH_{CT}	Conversion-time(7)	9 bit accuracy	275	µs
		11 bit accuracy	400	
		14 bit accuracy	660	

$TEMP_{CT}$	Conversion-time(7)	9 bit accuracy	225	µs
		11 bit accuracy	350	
		14 bit accuracy	610	

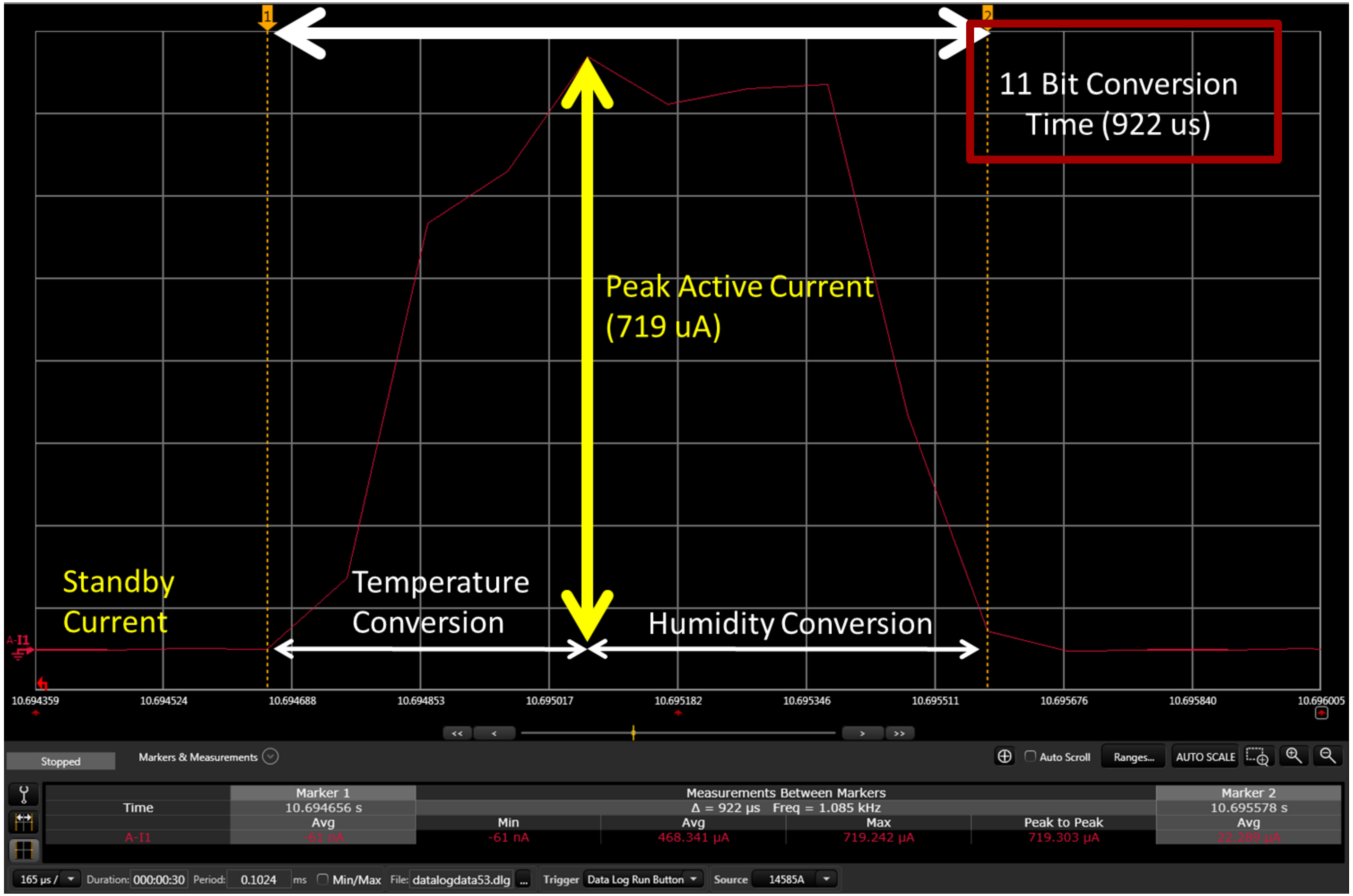
Digital humidity sensor conversion – 14-bit



Consider…

- Conversion time
- Active current
- Sleep/standby current
- Frequency of conversion

Digital humidity sensor conversion – 11-bit

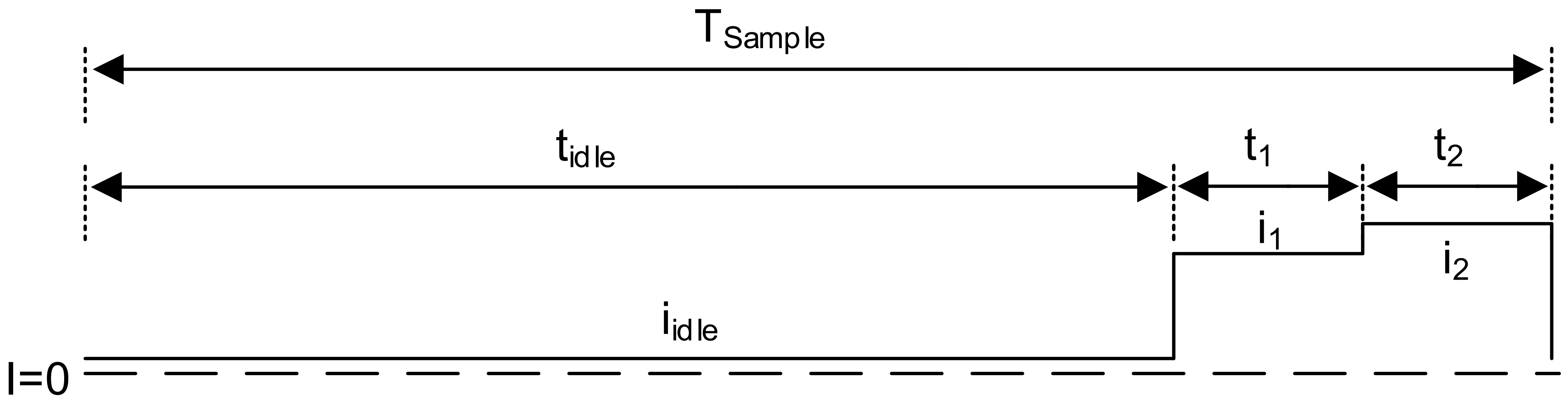


Consider…

- Conversion time
- Active current
- Sleep/standby current
- Frequency of conversion

Here, using a lower conversion rate setting will save our system power

Example: 14-bit average current consumption

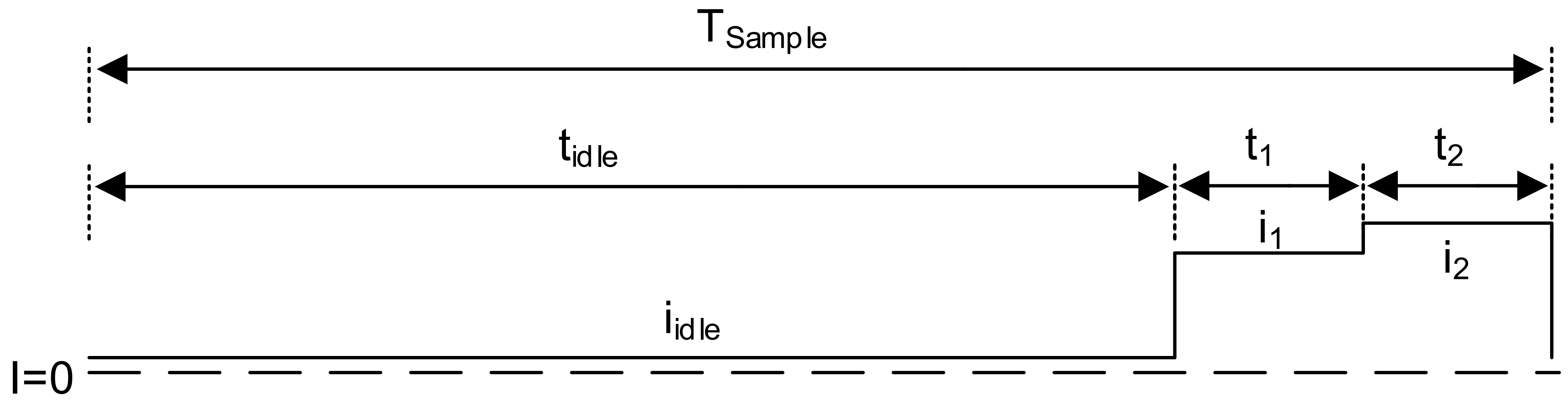


$$I_{AVG} = \frac{t_{idle} \times i_{idle} + t_1 \times i_1 + t_2 \times i_2}{T_{sample}} \qquad t_{idle} = T_{sample} - (t_1 + t_2)$$

$$I_{AVG} = \frac{(1s - 610us - 660us) \times 0.05uA + 610us \times 550uA + 660us \times 650uA}{1s}$$

$$I_{AVG} = \frac{(0.99873s) \times 0.05uA + 0.3355 + 0.429}{1s} = 0.814uA \rightarrow 5000 + \ days\ from\ 100mAh$$

Example: 11-bit average current consumption



$$I_{AVG} = \frac{t_{idle} \times i_{idle} + t_1 \times i_1 + t_2 \times i_2}{T_{sample}} \qquad t_{idle} = T_{sample} - (t_1 + t_2)$$

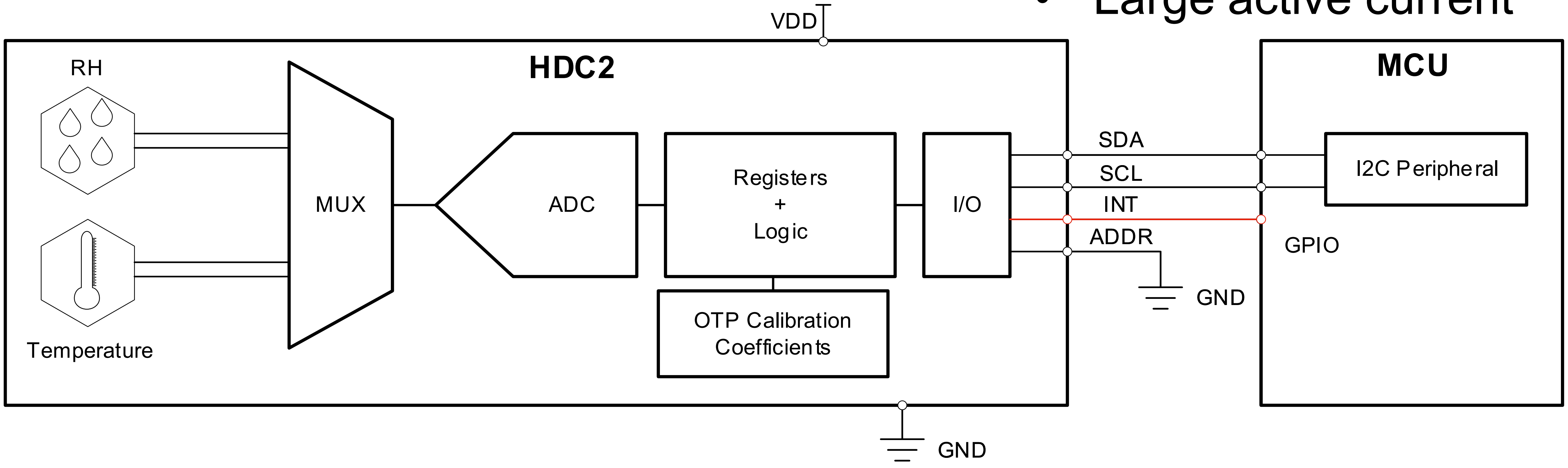
$$I_{AVG} = \frac{(1s - 350us - 400us) \times 0.05uA + 350us \times 550uA + 400us \times 650uA}{1s}$$

$$I_{AVG} = \frac{(0.99925s) \times 0.05uA + 0.1925 + 0.26}{1s} = 0.5uA \rightarrow 8000 + \ days\ from\ 100mAh$$

System power consumption

Digital humidity sensor
- Low sleep/standby current
- Modest active current

Microcontroller
- Low sleep current
- Modest standby current
- Large active current



Maximize MCU sleep time, minimize MCU active time

To find more humidity sensor resources and products, visit ti.com/humidity