CONFIDENTIAL REPORT

IQOS 3 Duo Operating Principles

Reverse-Engineering by Seed-Up

Author(s) : Rémi Guisse

Date : 22/05/2020

Revision : #1

Device Illustration :

Device Provenance Information :

Date and place of purchase: 01/2020 at “Tabac de Rivoli”, Paris

Serial number :

Firmware rev number: unknown

A. Packaging and Instructions Manual

Packaging


Kit IQOS™ 3 DUO:
Stylet IQOS 3 DUO A1406
Chargeur de poche IQOS 3 DUO A1505
Adaptateur secteur IQOS S21A20
Câble USB Type C
Outil de nettoyage IQOS
Tiges de nettoyage IQOS
Ingrédients du liquide de nettoyage : 50% isopropanol, 50% eau
Fabriqué en Malaisie
Fabricant: Philip Morris Products S.A., Quai Jeanrenaud 3, 2000 Neuchâtel, Suisse
Importateur: Philip Morris France SAS, 23-25 rue Delarivière Lefoulon, 92064 La Défense Cedex, France
2 utilisations consécutives
Service client 0800 814 814
Les accessoires du système IQOS™ seront disponibles chez les revendeurs agréés aussi longtemps que le système IQOS™ sera commercialisé.
REJOIGNEZ L'UNIVERS IQOS
Nouveau
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Technologie HeatControl
Ce produit ne peut être vendu à des mineurs.
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Packaging

Getting Started

TURN ON

Press and hold IQOS 3 DUO Pocket Charger Button for 4 seconds, then release. Holder Status Lights and Pocket Charger Status Lights will turn on slowly.

CHARGE HOLDER

Insert IQOS 3 DUO Holder into the IQOS 3 DUO Pocket Charger, then close door to charge.

Holder Status Light will show Holder charge level.

Check Holder Status

CHECK HOLDER STATUS

Press and release the Holder Button to check status.

Holder Lights indicate IQOS 3 DUO Holder battery level.

CHECK HOLDER STATUS ON IQOS 3 DUO POCKET CHARGER

Press and release Pocket Charger Button to check IQOS 3 DUO Holder battery level.

How to use your IQOS

CHECK HOLDER STATUS ON IQOS 3 POCKET CHARGER

Press and release Pocket Charger Button to check IQOS 3 DUO Holder battery level.

1. INSERT TOBACCO STICK

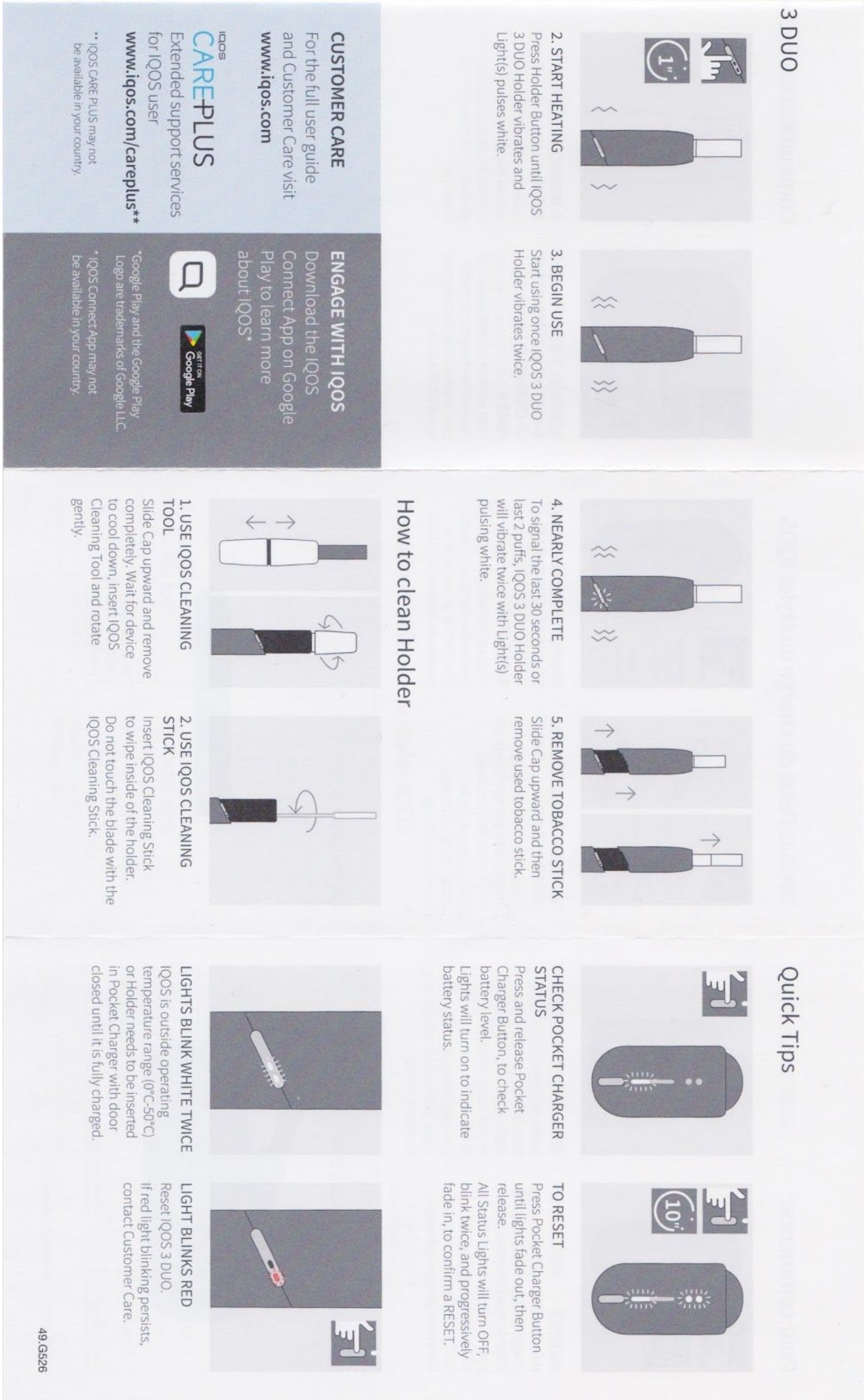
Insert and gently press the tobacco stick to the line on filter with filter facing outside.

IQOS 3 DUO Pocket Charger*

*IQOS 3 DUO is compatible with IQOS 3

IQOS 3 DUO Holder*

Instructions part 1



3 DUO

2. START HEATING
Press Holder Button until IQOS 3 DUO Holder vibrates and Light(s) pulses white.

3. BEGIN USE
Start using once IQOS 3 DUO Holder vibrates twice.

4. NEARLY COMPLETE
To signal the last 30 seconds or last 2 puffs, IQOS 3 DUO Holder will vibrate twice with Light(s) pulsing white.

5. REMOVE TOBACCO STICK
Slide Cap upward and then remove used tobacco stick.

How to clean Holder

1. USE IQOS CLEANING TOOL
Slide Cap upward and remove completely. Wait for device to cool down, insert IQOS Cleaning Tool and rotate gently.

2. USE IQOS CLEANING STICK
Insert IQOS Cleaning Stick to wipe inside of the holder.
Do not touch the blade with the IQOS Cleaning Stick.

Quick Tips

CHECK POCKET CHARGER STATUS
Press and release Pocket Charger Button, to check battery level.
Lights will turn on to indicate battery status.

TO RESET
Press Pocket Charger Button until lights fade out, then release.
All Status Lights will turn OFF, blink twice, and progressively fade in, to confirm a RESET.

LIGHTS BLINK WHITE TWICE
IQOS is outside operating temperature range (0°C-50°C) or Holder needs to be inserted in Pocket Charger with door closed until it is fully charged.

LIGHT BLINKS RED
Reset IQOS 3 DUO.
If red light blinking persists, contact Customer Care.

CUSTOMER CARE
For the full user guide and Customer Care visit **www.iqos.com**

IQOS CARE PLUS
Extended support services for IQOS user
www.iqos.com/careplus**

** IQOS CARE PLUS may not be available in your country.

ENGAGE WITH IQOS
Download the IQOS Connect App on Google Play to learn more about IQOS*

GET IT ON Google Play

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* IQOS Connect App may not be available in your country.

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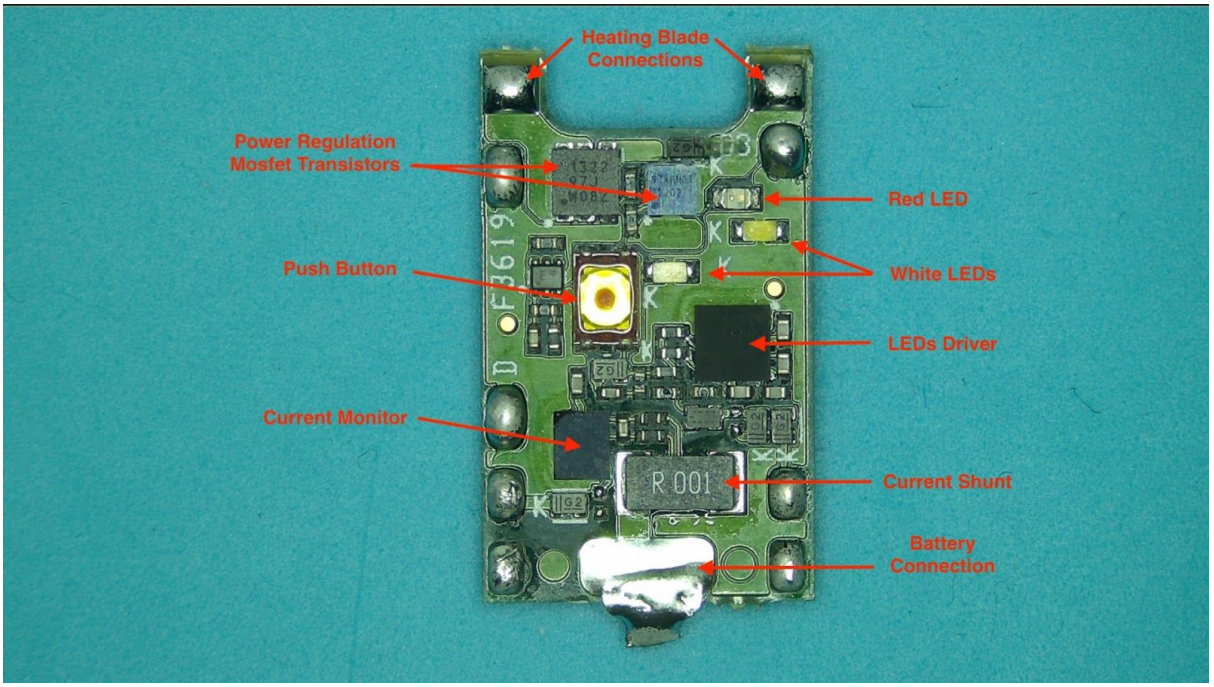
Instructions part 2

B. Teardown

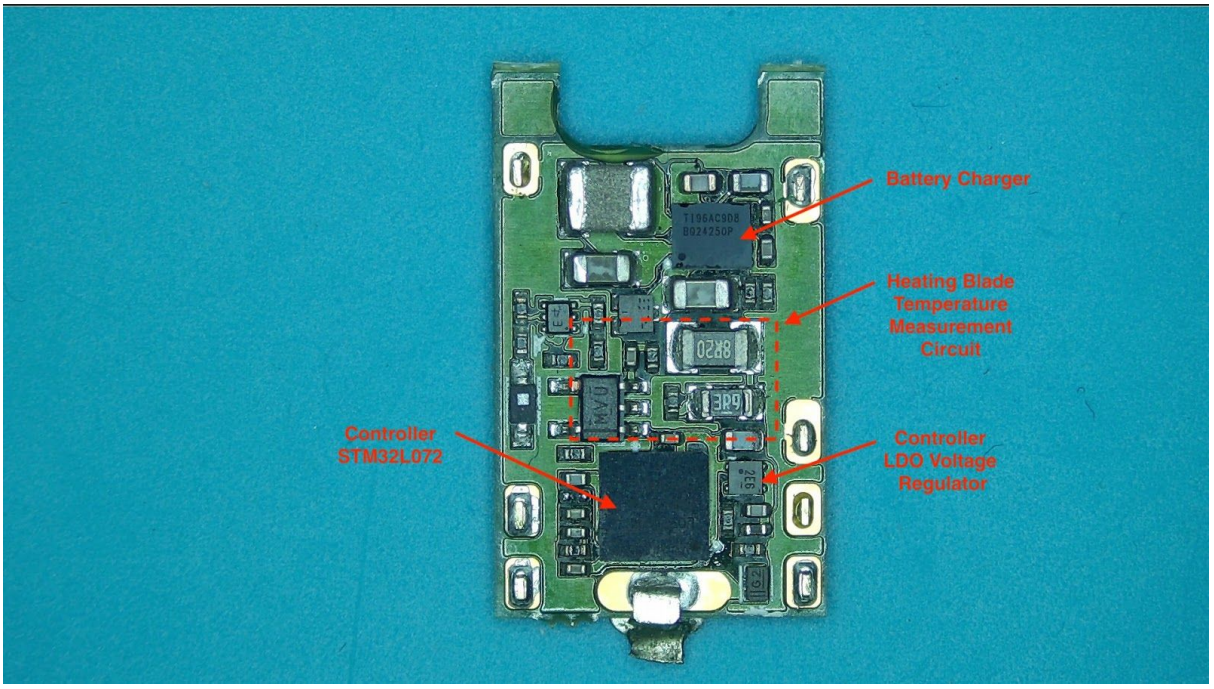
The IQOS 3 Duo is composed of two devices : the holder and the pocket charger.

a. Holder

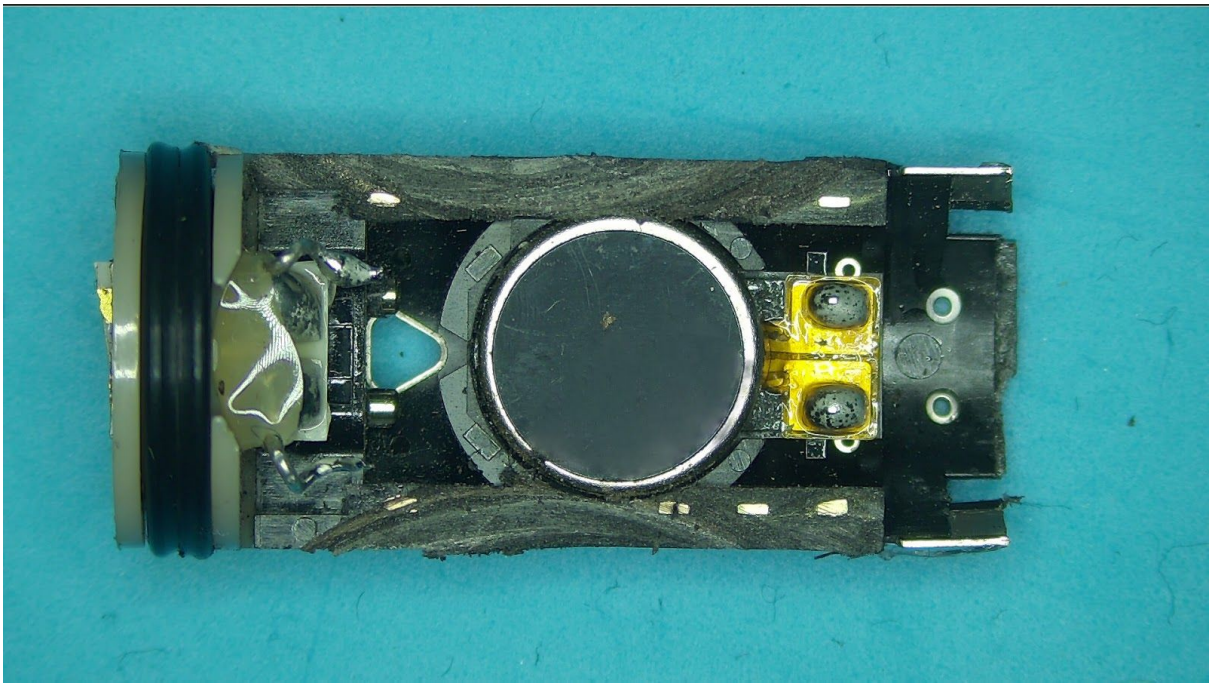
Exploded View



PCB Front Side

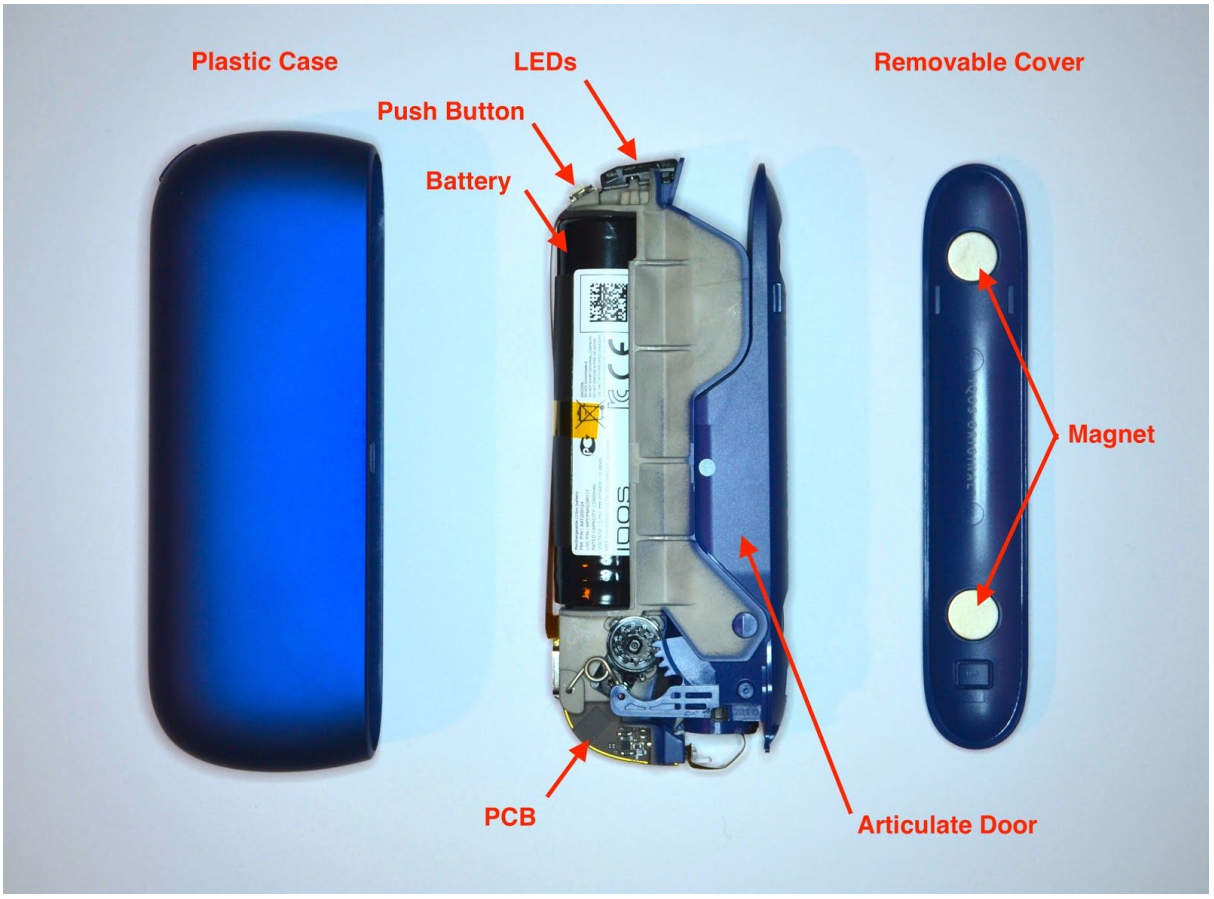


PCB Back Side

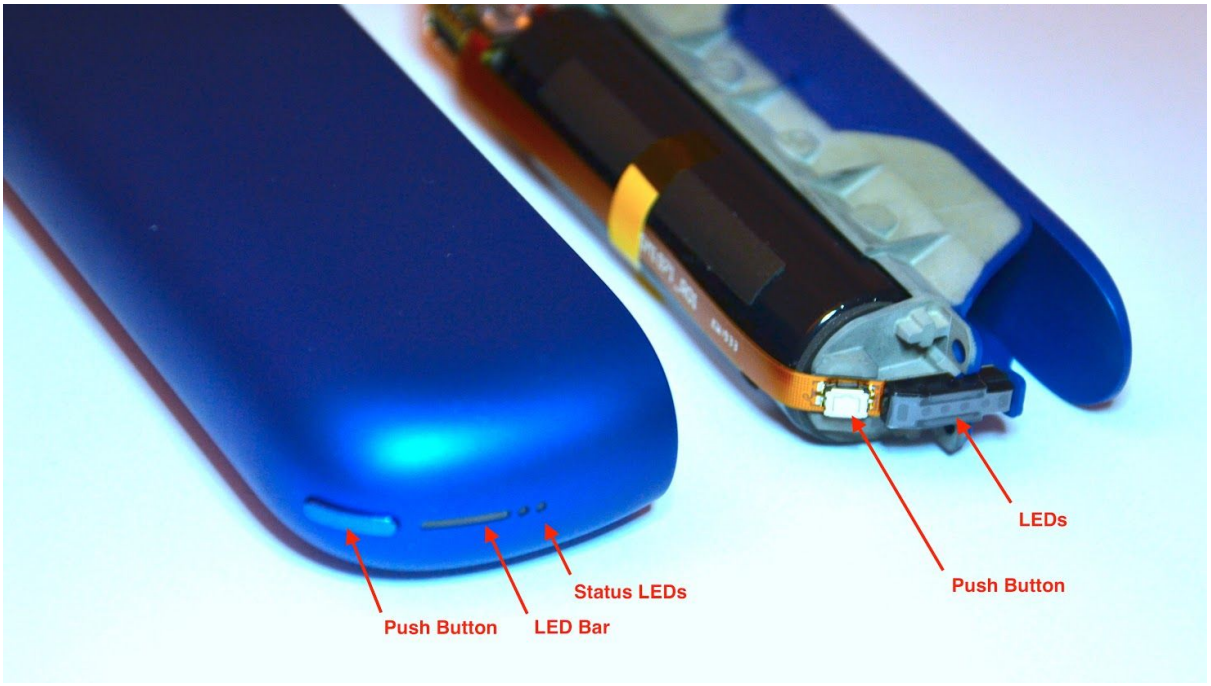


Vibrator

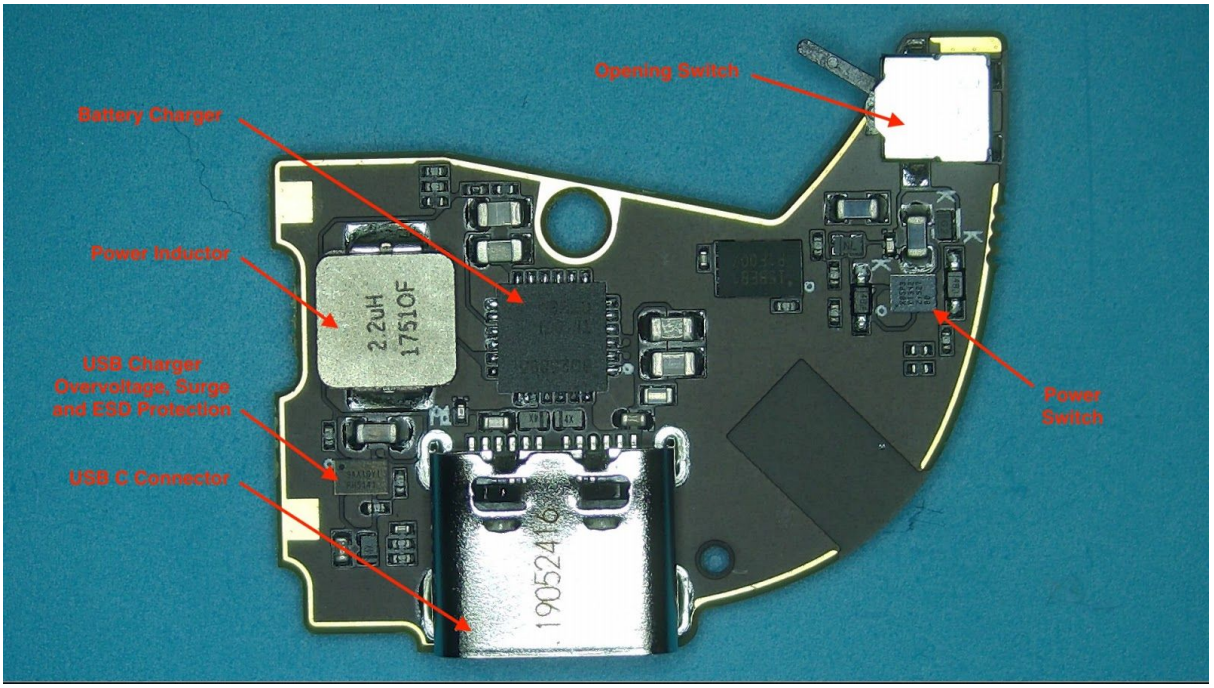
b. Pocket Charger



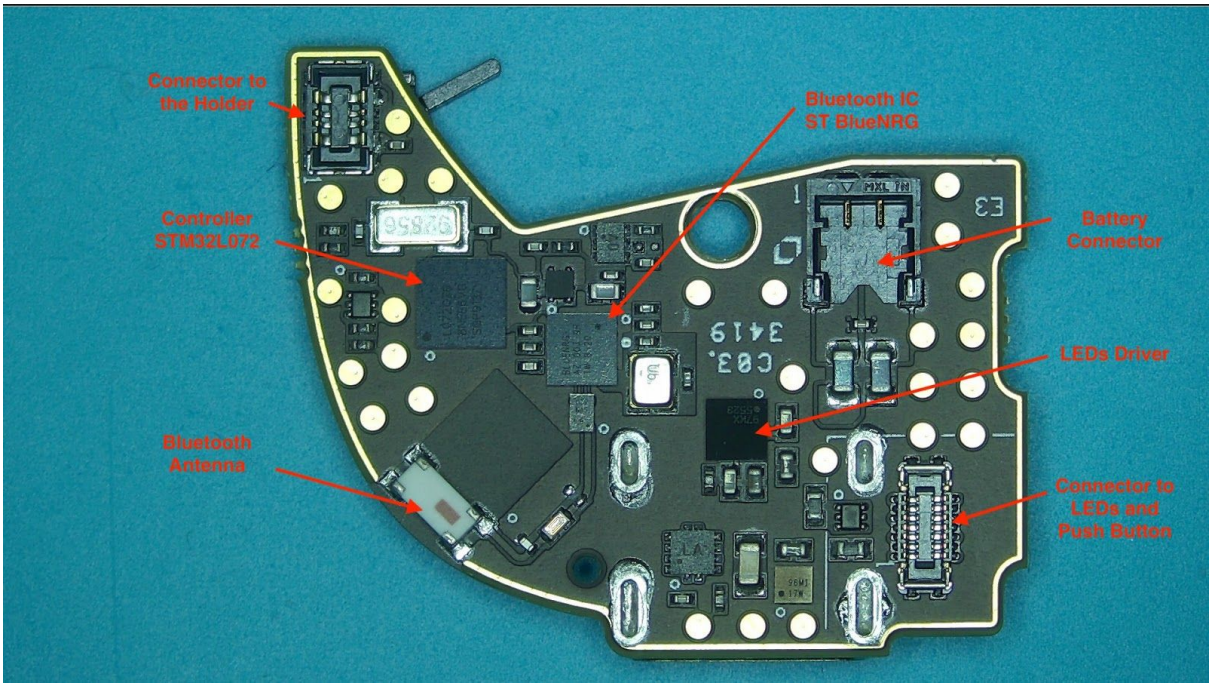
Exploded View Front



Side View (LEDs and Push Button)

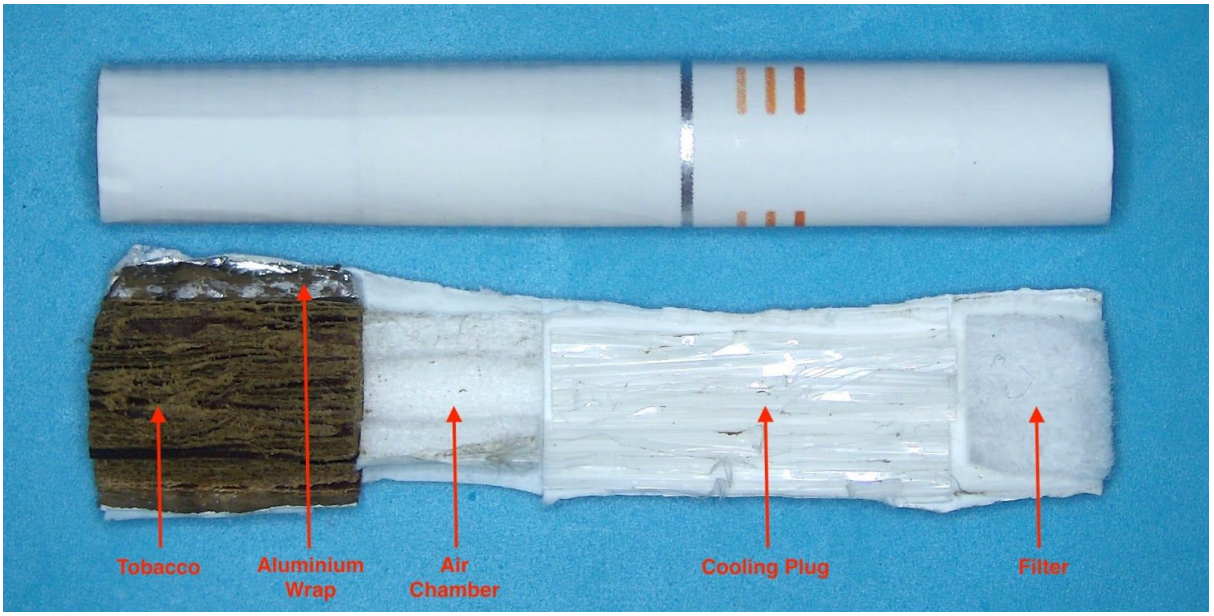


PCB Front Side



PCB Back Side

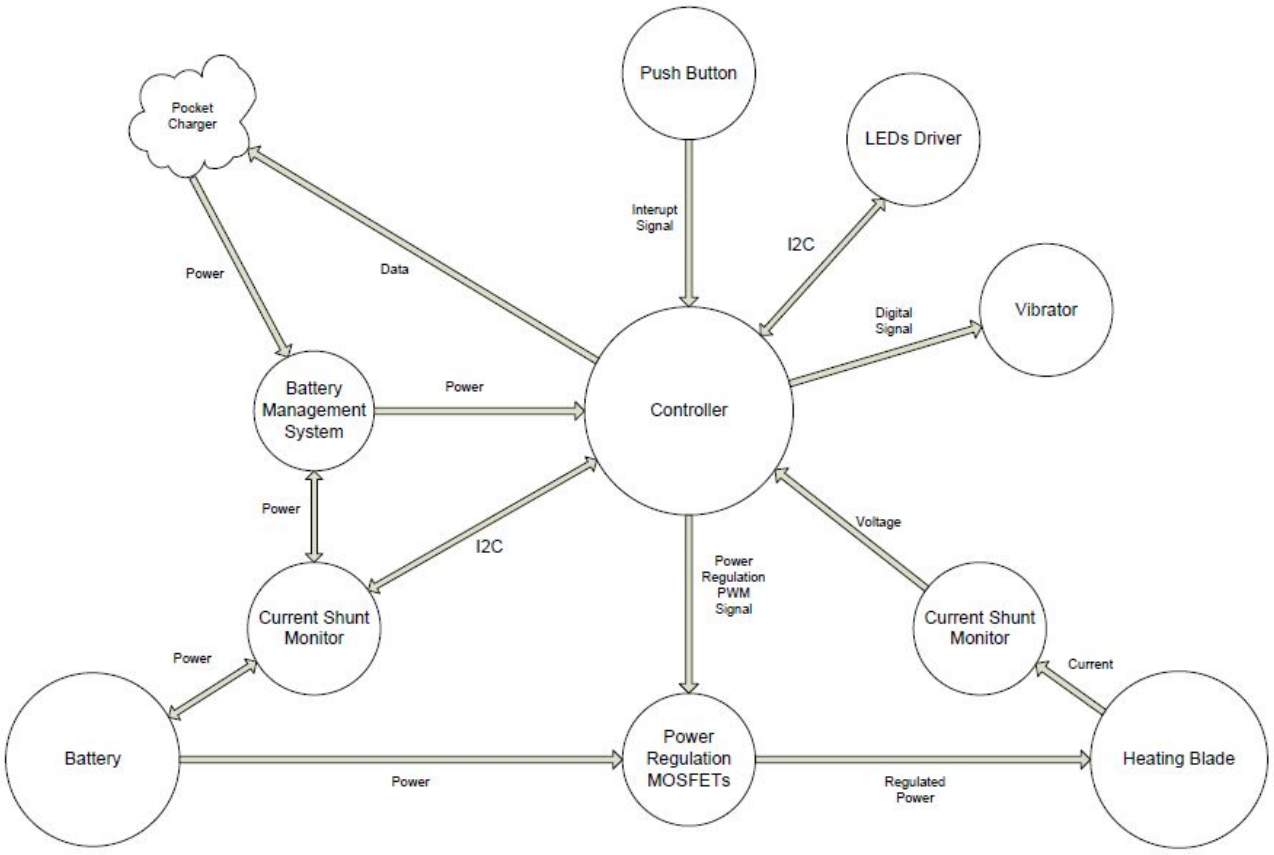
c. Tobacco Stick



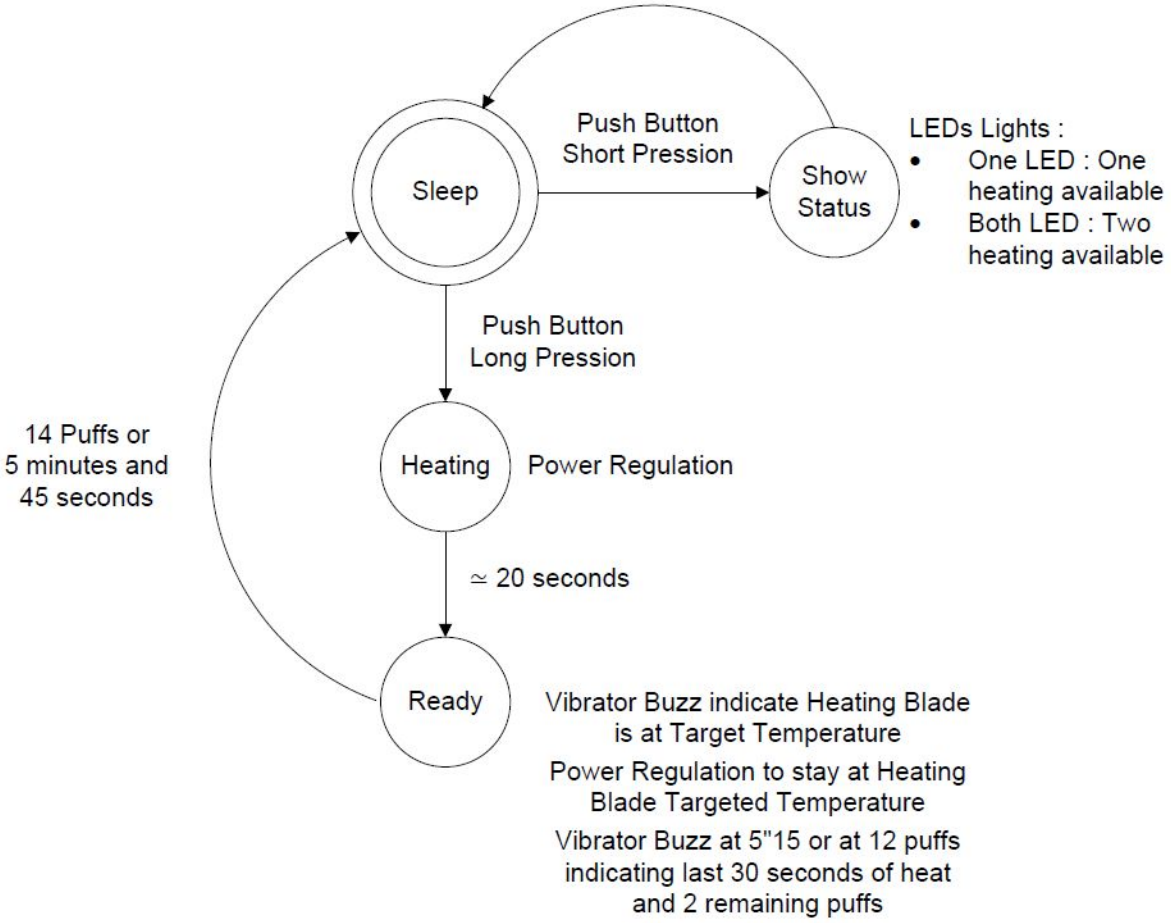
HEETS Sectional View

Reference for HEETS components labeling : https://uk.iqos.com/products/what-are-heets.

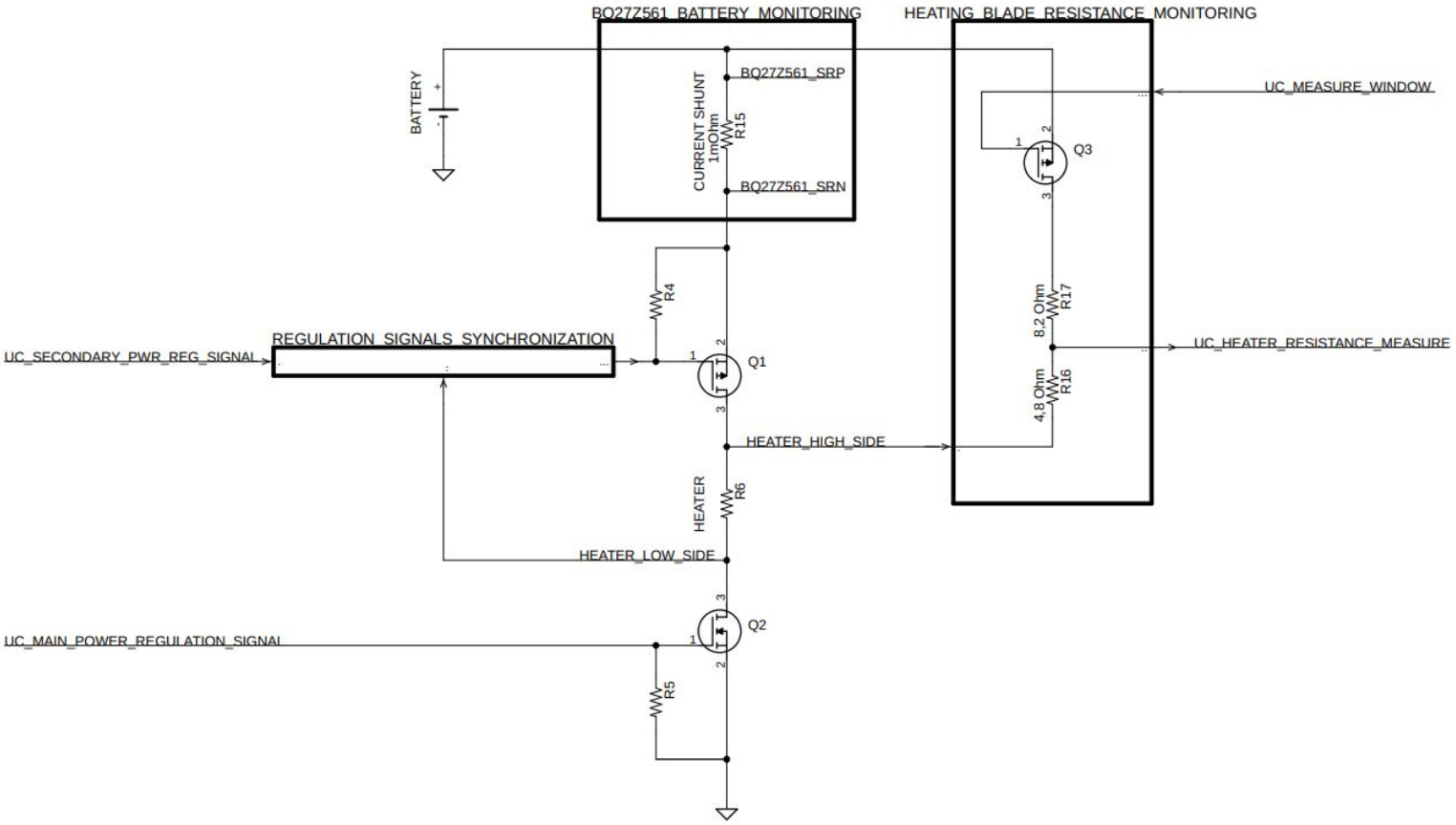
C. Holder Block Diagram



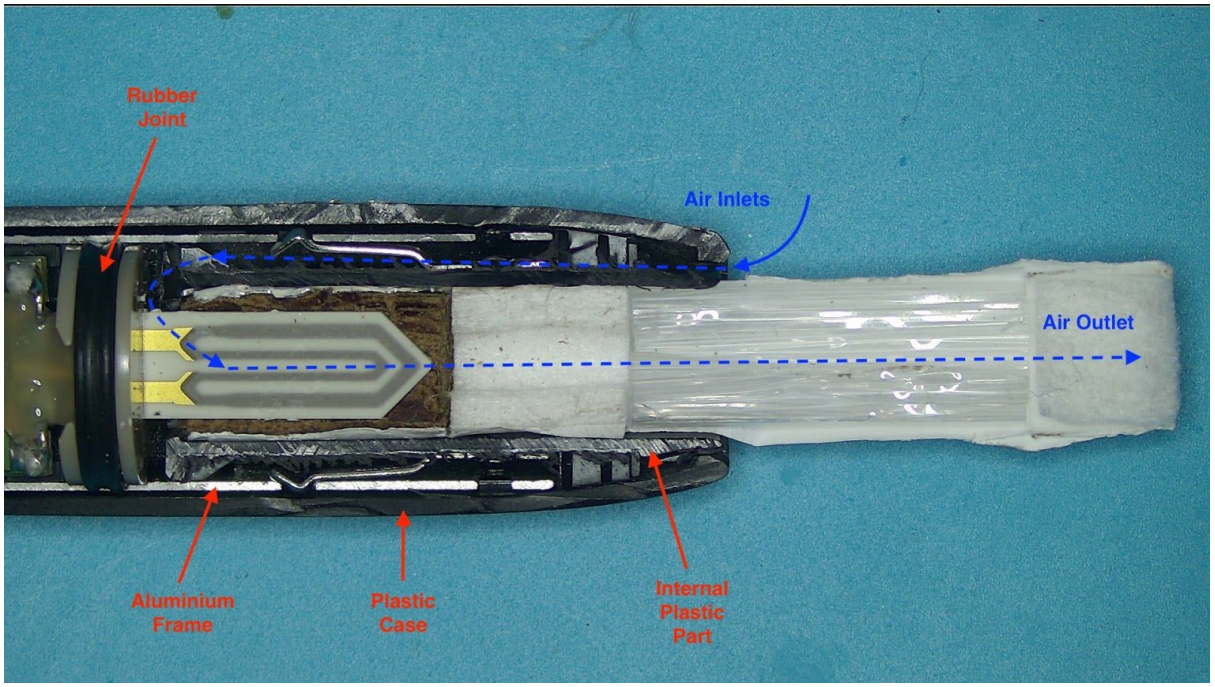
D. Holder Control Diagram



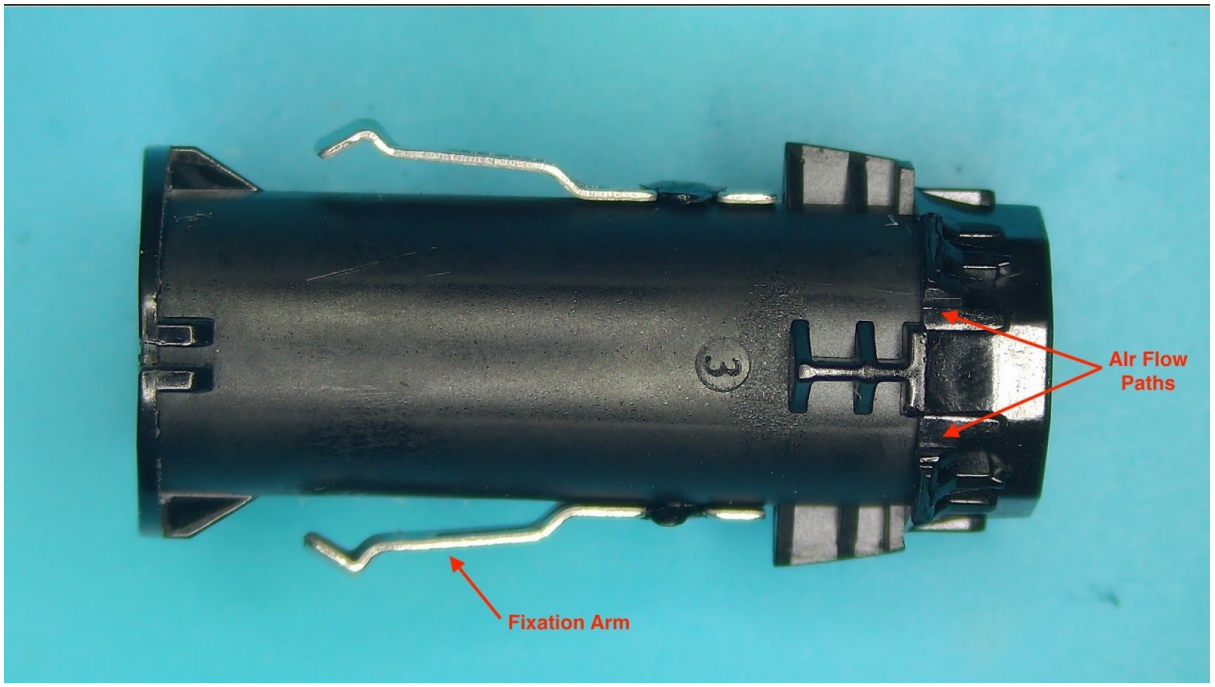
E. Heating Blade Power Control Simplified Electronic Schematic



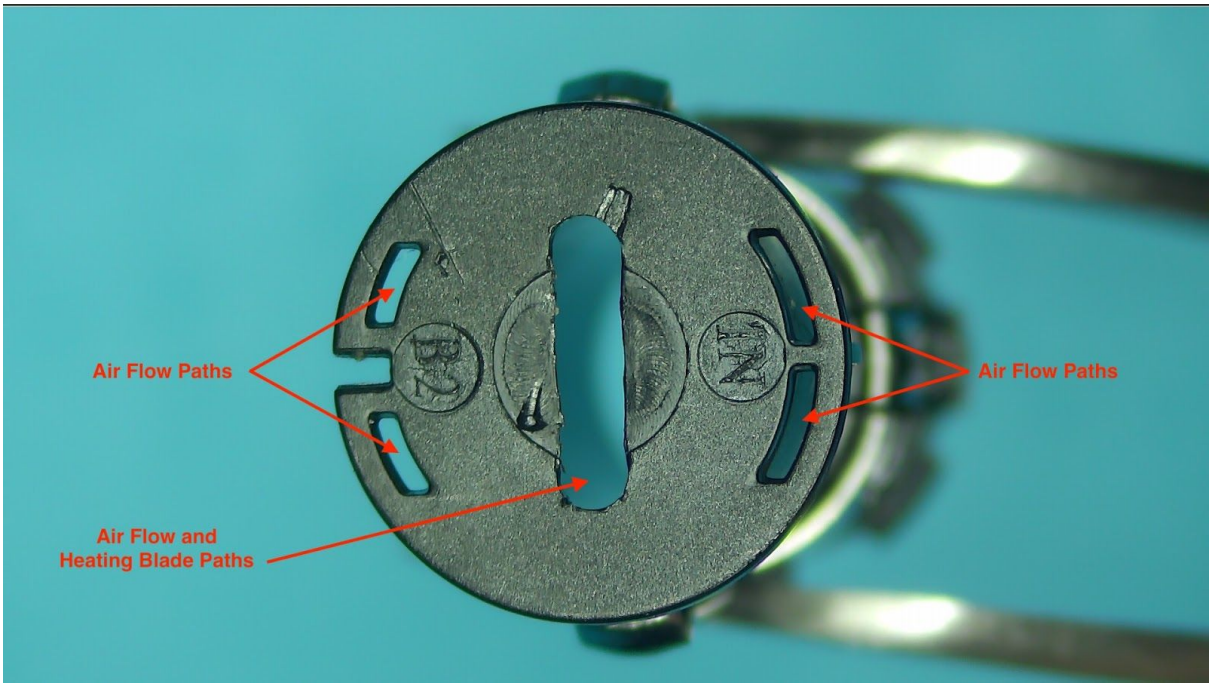
F. Air Flow Diagram



Air Flow Diagram



Internal Plastic Part



Internal Plastic Part (pic 2)

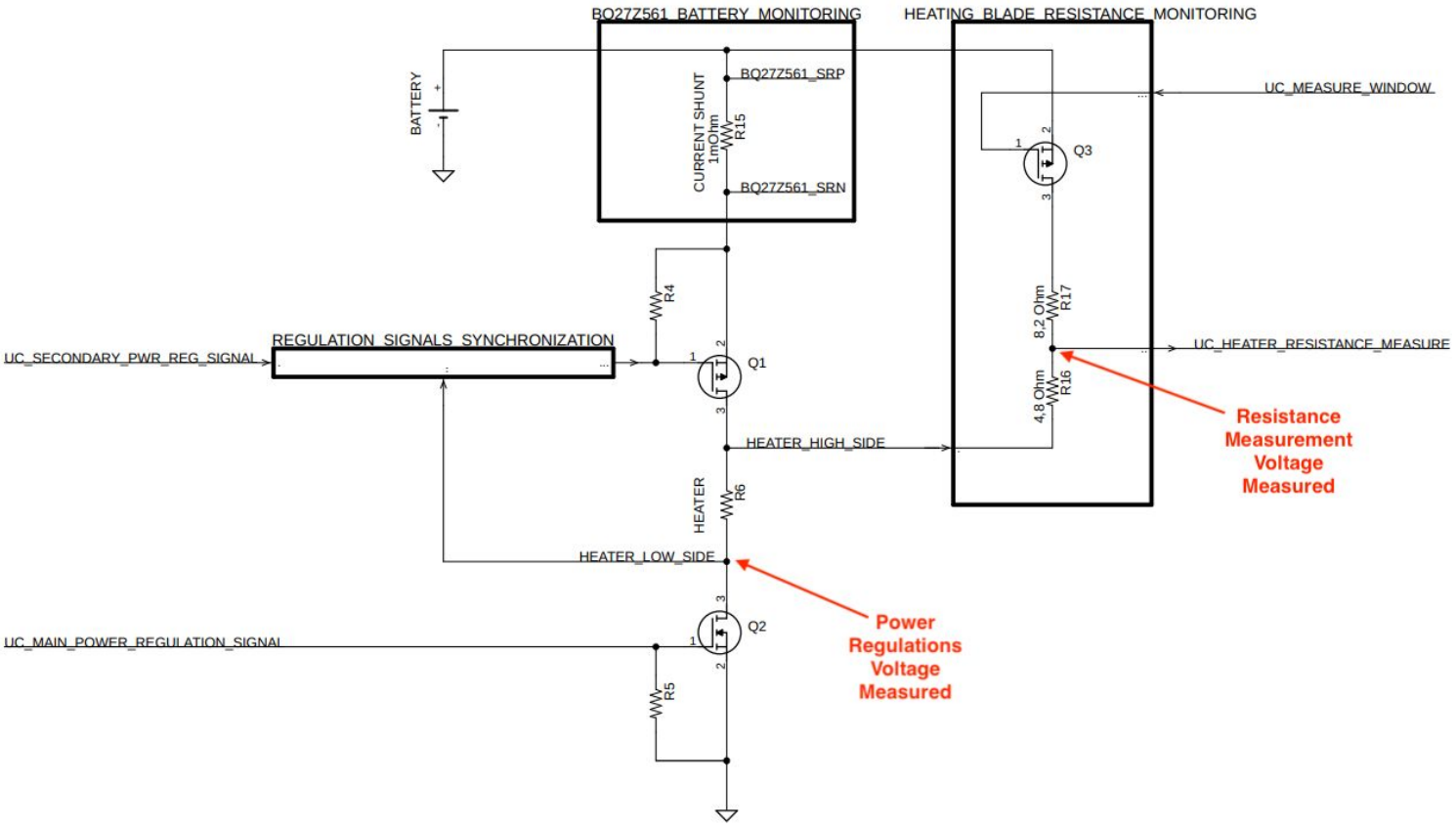
G. How Does It Work? (Power Control Analysis)

1) Preheat

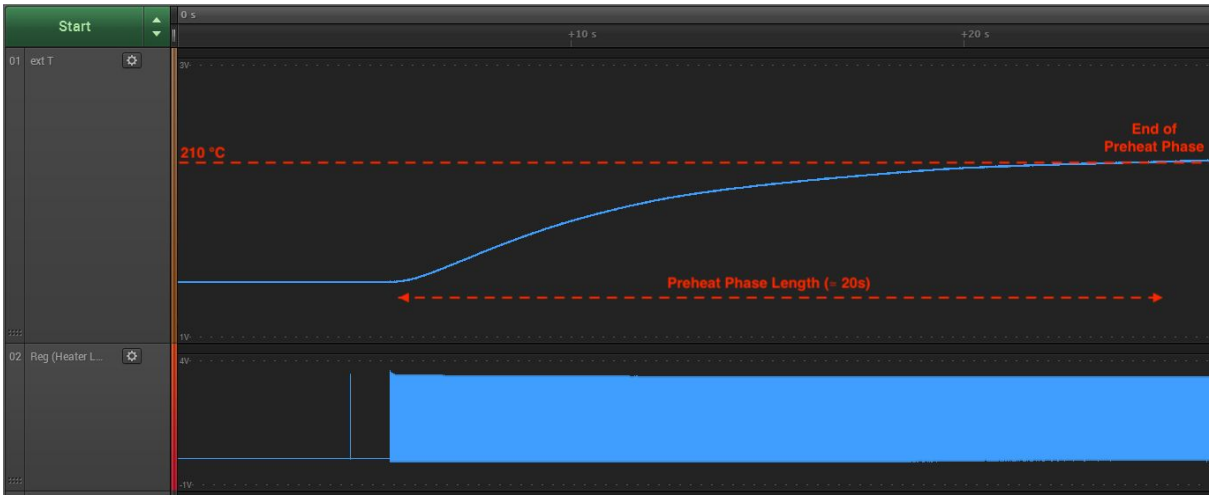
After a long press on the holder button, the system enter in a preheat phase.

During the preheat phase the controller send regulations signals to both power mosfets Q1 and Q2.

The controller is monitoring the heating blade resistance during measurement windows during which Q1 is OFF, Q2 is ON and current flowing from Q3 in the heating blade via the resistors R16 and R17 as voltage divider. The output of the voltage divider goes into the controller which can calculate the heating blade resistance (image of its temperature).



Simplified Electronic Schema With the Tests Point of the Graphs Below



Preheat Heating Profile

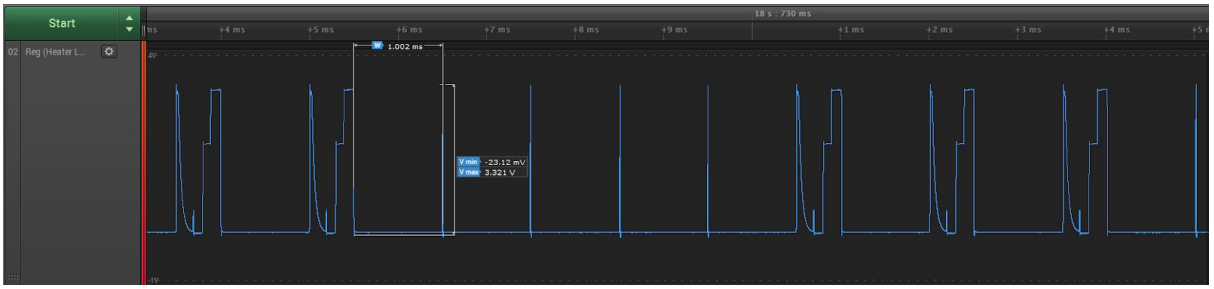
During the preheat phase the controller is targeting the operating temperature. This temperature measured with a thermocouple is approximately 210°C (+/- 5°C).

The preheat phase takes approximately 20 seconds. During this phase the holder LED is blinking. When the operating temperature is reached the device vibrate and the LED become steady.

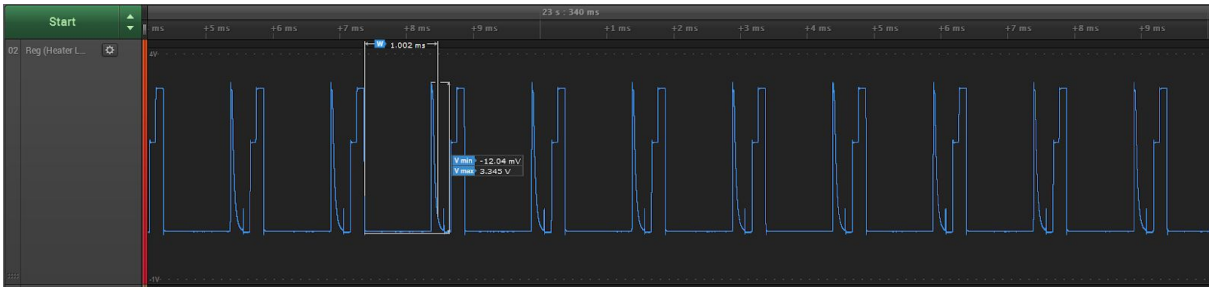
Below a zoom on the regulation at the beginning of the preheat phase. As the measured point is the low side, the current flow in the heating blade when the signal is low.

Zoom on Power Regulation

The regulation is divided by part of 1 ms. Every 5 ms a heating blade resistance sensing window occur. As the heating blade is getting hotter the measurement windows occur more often and thus less power is delivered to the heater.

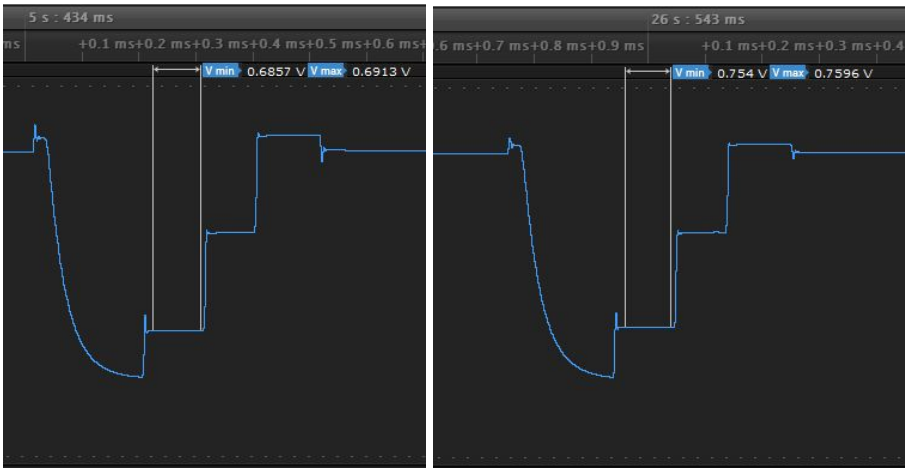


Zoom on Power Regulation 2



Zoom on Power Regulation 3

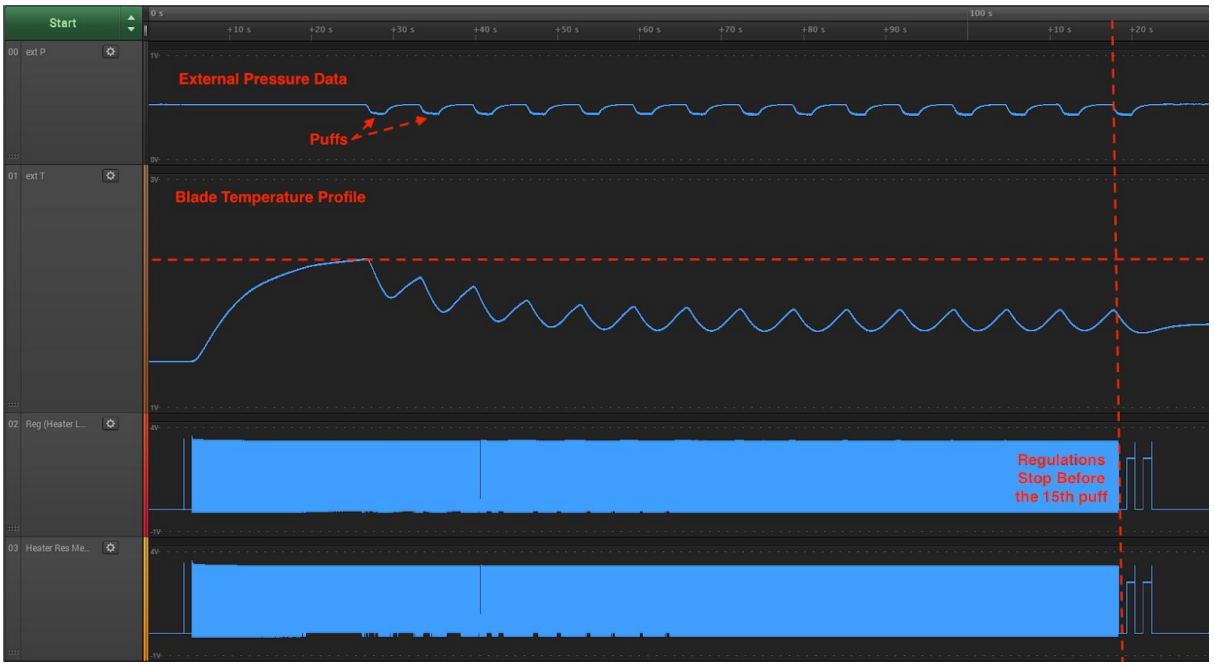
Below a zoom on the output of the voltage divider at the beginning of the preheat phase and at the end.



Zoom on resistance measurements

2) Blade Temperature Monitoring and Puffs Counting

The smoke session is limited to 6 minutes or 14 puffs. To achieve this feature the controller count the puffs with the heating blade resistance measurement.

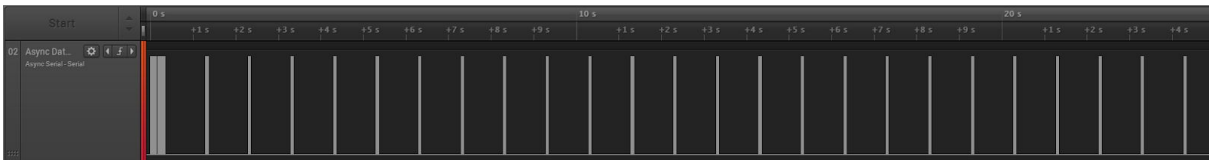


Complete Heating Profile with 15 puffs

Before the last two puffs the device vibrate and the LED start blinking.

3) Charging : Connexions Between the Holder and the Pocket Charger

During the charge an Asynchronous serial communication is set between the holder and the pocket charger, exchanging puffs data informations and battery state of charge informations.



Data Transfer To The Pocket Charger During Holder Charge

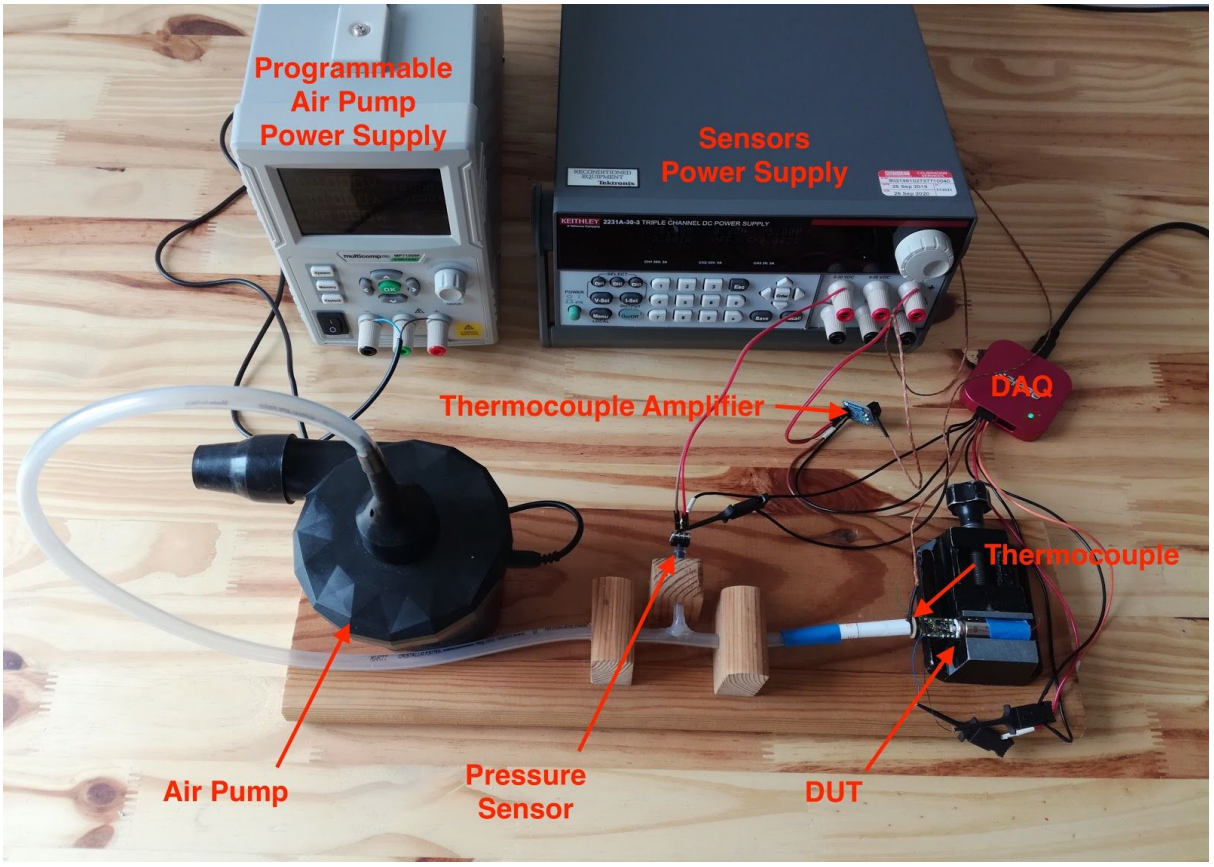
H. Test Scenario

The description of how the system work can be validate by a third party according to the following test scenario :

Goals :

- Getting the IQOS heating profile.
- Validate the influence of temperature on puff count.

Experiment Setup :



Test Bench

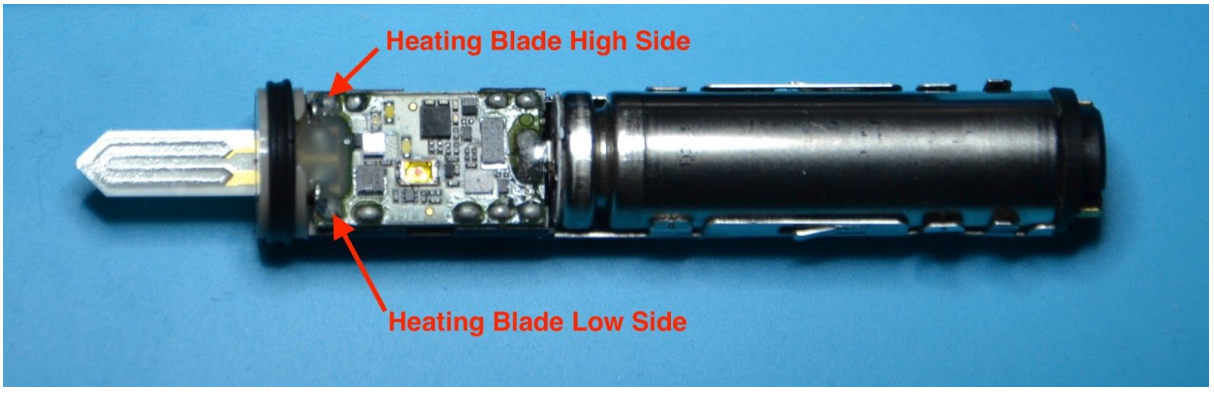
- MSO Oscilloscope with large memory depth or logic analyser with mixed signals (Saleae Logic)
- Generic 12V air pump
- Programmable power supply (Multicomp Pro MP710086)
- Pressure sensor (Honeywell SSCSANN001BGAA5)

- Thermocouple (Type K)
- Thermocouple amplifier (Adafruit AD8496)
- DC power supply for the sensors (Keithley 2231A)

Step by Step Guide :

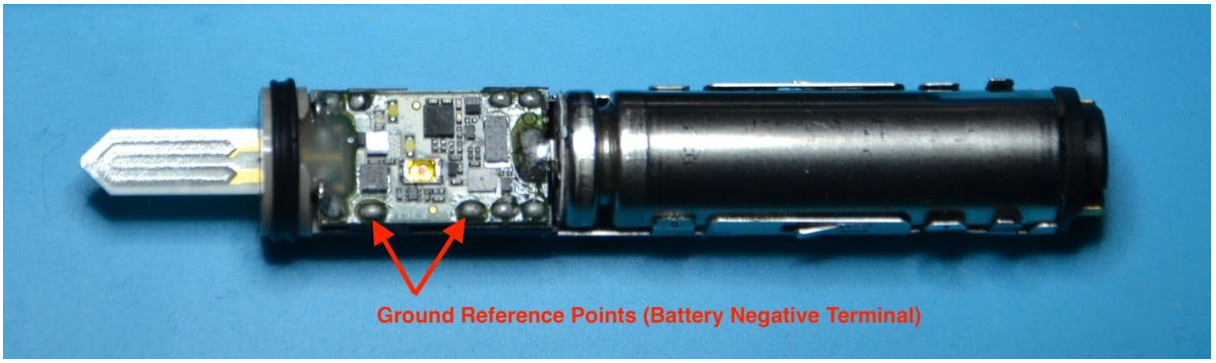
Step 1 : Open the IQOS.

Step 2 : Solder sensing wires to the heating blade terminal



Localization of the Heating Blade Low Side and High Side

Step 3 : Solder sensing wires to the circuit ground.



Localization of ground references points (Battery Negative Terminal)

Step 4 : Place the thermocouple on the blade while inserting a HEETS on the blade.

Step 5 : Start your measurement and launch the system preheat.

Step 5 : When the preheat phase is complete (device has vibrated and LED is become steady), launch the automated puffs. As an example, this python script set ON and OFF the power supply pump for 15 puffs :

```
# IQOS Test Bench Air Pump Control Script
# Reverse-Engineering by Seed-Up
# Author : Rémi Guisse

import pyvisa
import time

rm = pyvisa.ResourceManager()
psu = rm.open_resource('USB0::0x5345::0X1235::2001043::INSTR') #change to your instrument id
print(psu)

psu.read_termination = '\n'
psu.write_termination = '\n'

print(psu.query('*IDN?')) #verify the connection with your instrument

delay = 0.1

#100 puffs loop :
for i in range(15):
   psu.write('OUTP ON') #Turn PSU output ON
   time.sleep(2.5)              #Stay On for 2.5 seconds
   psu.write('OUTP OFF')        #Turn PSU output OFF
   print(i)                     #Print puff number
   time.sleep(4)                #4 seconds pause before the next puff


print('15 puffs DONE !')
```