



## NHS3100 PCB temperature logger demo

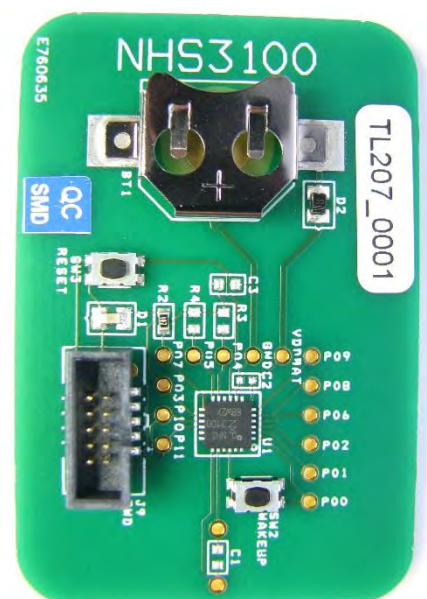
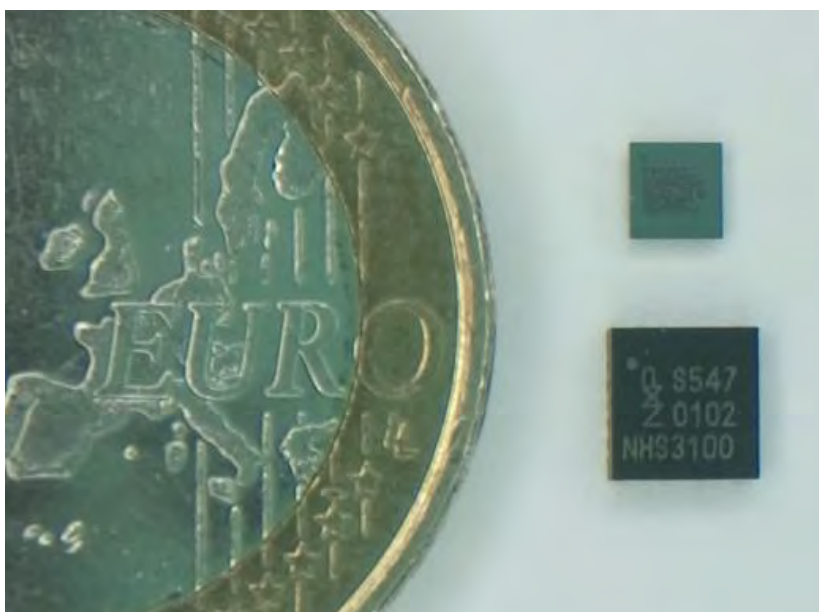
### Welcome

Dear Madam, Dear Sir,

Thank you for your interest in our NHS3100 temperature logger chip!

A cost-effective, small and fully configurable cold chain monitoring solution, based on the NXP NHS3100 chip, can easily be demonstrated with the contents of this package.

All communication with the chip – both configuration and data read-out – occurs via the NFC interface.



## Prerequisites

In addition to the enclosed PCB, you will also need the following:

- A coin cell battery of type CR1225.
  - Insert the coin cell in the coin cell holder on the demo PCB. The negative electrode of the battery should be at the bottom, closest to the PCB.
- An NFC enabled Android smartphone running 4.2 Jelly Bean or higher.
  - Any NFC-enabled smartphone can read the status text message, using the standard NFC NDEF Text message format. However, the Android app *NHS3100 Temperature Logger* is required if you want to enable the NHS3100 IC and execute a full data readout. This app can be found on the Google Play Store. Use the QR code aside or the link below:



<https://play.google.com/store/apps/details?id=com.nxp.nhs31xx.demo.tlogger>

# NHS3100 Demonstration PCB

This demonstrator circuit board consists of the following:

1. An NHS3100 IC in a HVQFN24 package (U1).
2. An SWD connector (J9).
3. A coin cell holder for stand-alone operations (BT1).
4. One SW controllable LED (D1).
5. A tactile switch (SW3) connected to the RESETN pin.
6. A tactile switch (SW2) connected to the WAKEUP pin.

Plus a set of through-holes to easily access:

7. All PIOs of the IC (P0x)
8. GND and VDDBAT.
9. Antenna coil connections LA and LB, connected with the NFC antenna on the back (not pictured).

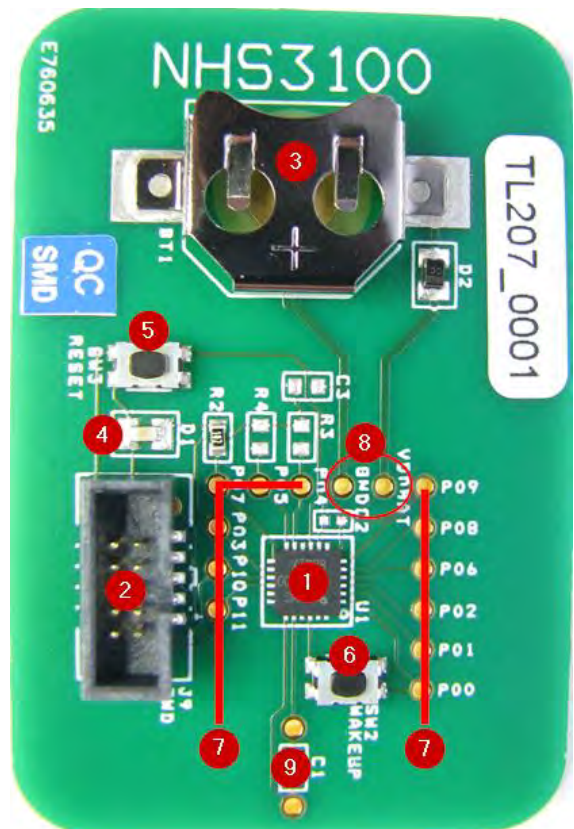


Figure 1: Front view of the demo PCB



# Quick start guide

1. Launch the app The initial screen shown in Figure 2 appears.
2. Hold the NHS3100 demonstrator close to where the NFC antenna of the phone is located. A small notification appears near the bottom of the screen telling you that the phone has found an NFC tag. When communication with an NHS3100 IC is established, a second notification appears informing you that an NHS3100 tag has been found (Figure 3).

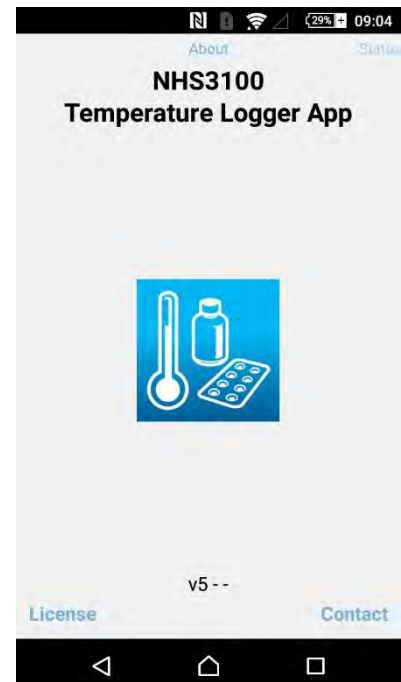


Figure 2: Initial screen after launching the app.

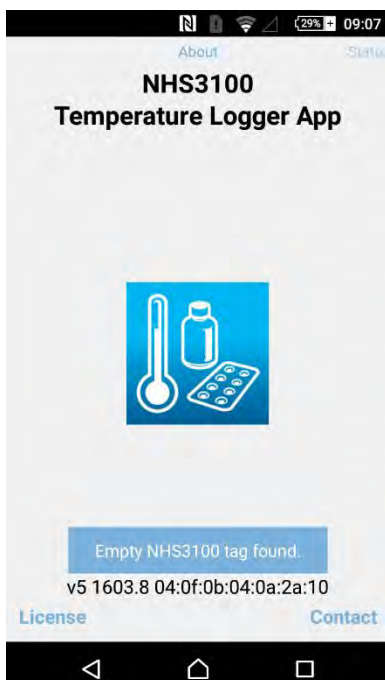


Figure 3: The status of the current connection and communication is displayed through numerous notifications

*Note:* For the app to start communicating, the license agreement must first be accepted. Whenever a tag is held close, a popup appears containing the conditions of the license agreement. After reading and accepting the license agreement, you must retouch the tag before continuing.

*Note:* The location of the NFC antenna is not always apparent and varies depending on manufacturer and phone type. It may take a few attempts to find an optimal location for the communication with the NHS3100 demonstrator.

*Note:* The maximum distance that still allows communication between the phone (the *tag reader*) and the NHS3100 (the *tag*) is also variable. The NFC chipset that is used in the phone and the material of the casing of the phone, among other factors, cause very different experiences.

*Note:* As long as the PCB is kept at roughly the same position in relation to the phone, the app and the NHS3100 demonstrator will maintain the connection.

*Note:* Even when started, the NHS3100 IC will not store any measurements for as long as an NFC connection remains established.

3. Swipe the screen a few times to the left until the *Config* screen is displayed.

Enter a number of seconds as the interval between temperature measurements.

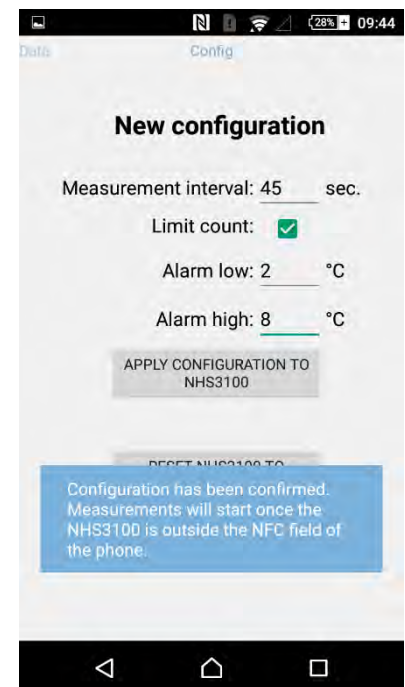
Optionally, fill in the lower and upper boundaries for the temperature alarm.

Click the *Apply* button.

4. Next, two notifications appear: the first notifying that the configuration has been sent to the demo PCB,
- the second providing a confirmation from the NHS3100 IC.

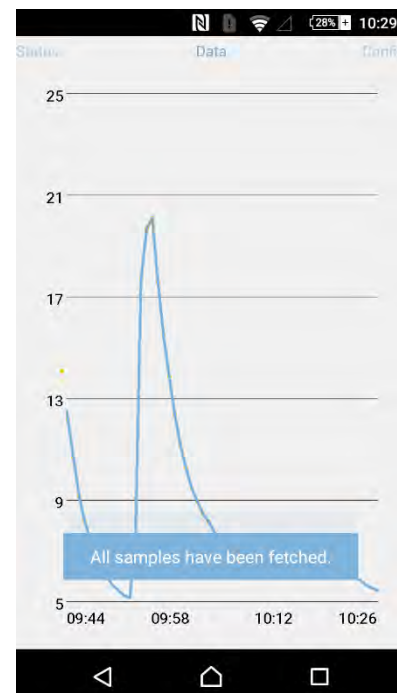
When these confirmations are given, the demo PCB is fully set-up and ready to start measuring.

Move the NHS3100 demonstrator away from the phone to start logging. When the connection is lost, the phone gives you a notification of this.



*Figure 4: Notifications inform the user about the ongoing communication*

5. Wait for a period of time to give the NHS3100 IC the chance to take a few measurements (this time depends on the measurement interval that was configured).
6. Bring the NHS3100 demonstrator back in range of the NFC antenna of the phone. As in step 2, two notifications appear. However, the second notification now also provides the number of measurements which are available on the NHS3100 IC. A full read-out automatically begins, and you are informed when all samples have been read.
7. Swipe once to the right to the Data screen to see all logged values over time (figure 5).



*Figure 5: The graph shows both the history data and the newly retrieved temperature values*





# User manual

The Android app *NHS3100 Temperature Logger* is used for all interaction with the demo board. This demonstrator app is kept simple and consists of 4 screens. Each screen can be accessed by swiping left or right.

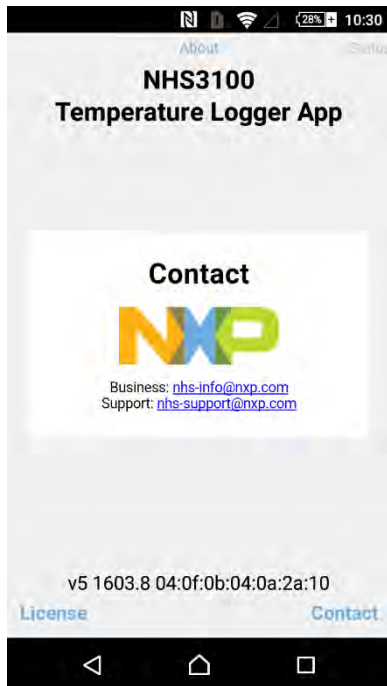


Figure 7: Initial screen after tapping on Contact

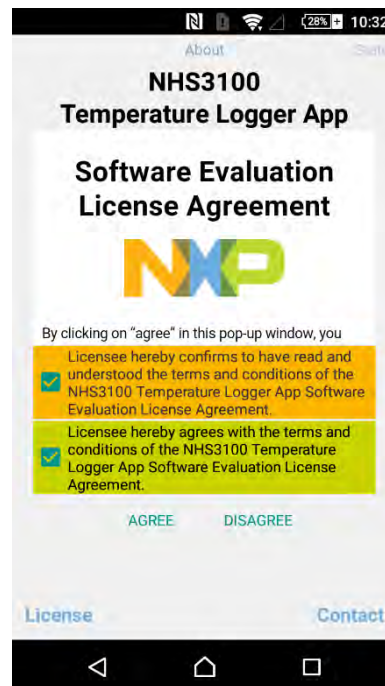


Figure 7: Initial screen after tapping on the logo

## About screen

This is the initial screen when the app is launched. You can accept or reject the license agreement, and find contact information from here.

1. You can accept or revise your agreement with the license of the app by tapping the logo.
2. Tapping on *License* will pop-up the full license agreement.
3. Tapping on *Contact* will pop-up the contact information to where you can direct all questions and requests.
4. You can dismiss a pop-up with the phone's back button or by changing the screen orientation.
5. When a tag has been detected, it lists its tag id here. When the tag is an NHS3100, it additionally lists the version of the NHS3100 application.

## Status screen

The status screen gives the full status information as fetched from the NHS3100 IC.

1. The date listed is the absolute time of the configuration of the NHS3100 IC. The exact time when each temperature was taken can be calculated using this and the *measurement interval*.
2. When the *Measurement interval* is negative or zero, the NHS3100 IC remains in a low-power mode until an NFC field is detected.
3. The *Number of samples* is the number of temperature values that are available on the NHS3100 IC. The app checks whether there are samples which have not yet been transferred to the phone, and fetches only the remaining portion of all the samples.
4. The NHS3100 IC decides autonomously when to stop taking measurement samples when you have the *Count limited* set. This may be advantageous when giving demonstrations, as you then don't have to remember to stop the NHS3100 IC when your demonstration has ended. For more information about this, see the explanation for the *Config screen*, below.

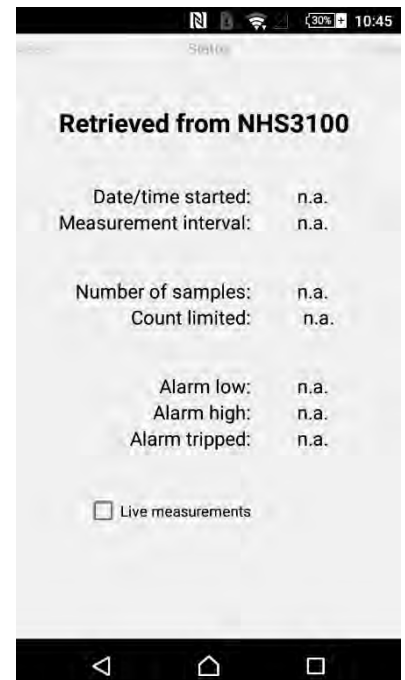


Figure 8: Status screen when no tag was held close before.

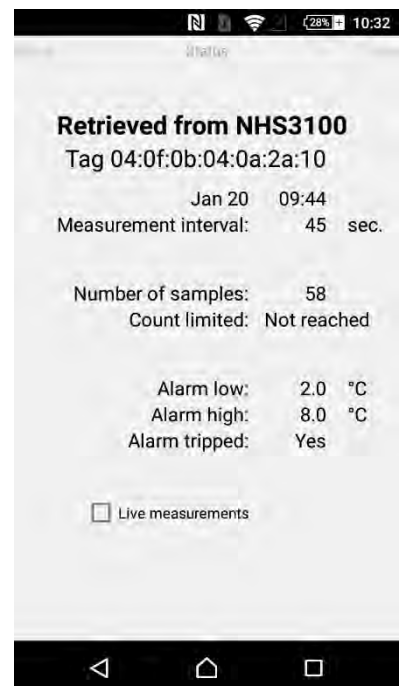


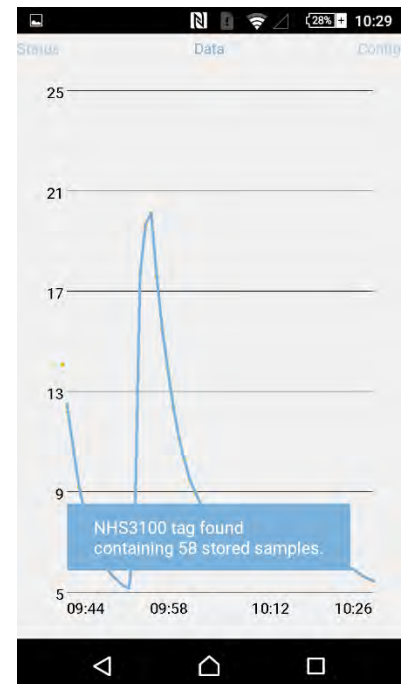
Figure 9: Status screen listing information about the last held tag

5. *Alarm low* and *Alarm high* are temperature threshold values; temperatures are considered valid when they fall within this range. Temperatures outside this range trip the alarm and are marked by the NHS3100 IC in its status information.
6. Status info posted by the NHS3100 IC indicates when at least one measurement was outside the temperature range, as defined by the threshold values *Alarm high* and *Alarm low*.
7. The *Live measurements* checkbox instructs the phone to read out the current temperature continually. It allows you to see the effect of a warm object (the phone itself) and superfluous energy in the NFC field (of the phone) on the NHS3100 demonstrator.

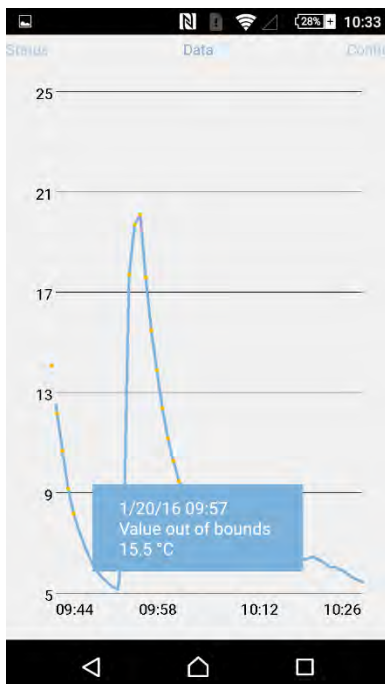
## Data screen

New samples are read out from the NHS3100 IC, and the previously fetched data samples are immediately restored from the phone's internal storage, when a tag is held close to the phone's NFC antenna.

1. To see the individual sample values, tap on the graph.
2. Samples that lie outside the range defined by the thresholds are differently colored.



*Figure 10: Data screen showing the temperature values retrieved from the NHS3100*



*Figure 11: Data screen showing the notification when tapping on the graph*

## Config screen

You can set-up a new measurement cycle on the NHS3100 IC with the last screen.

1. *Measurement interval* is the time between measurements. Only one value can be specified in this demo app. For your own application, however, you can easily specify multiple measurement intervals.

The NHS3100 IC will only take measurements when a positive integer is specified here.

2. *Limit count* restricts the number of measurements the NHS3100 IC will take before going to a low power. After the limit is reached, the NHS3100 IC waits indefinitely for an NFC field which will allow it to transfer all its measured data. The limit count is dependent on the *Measurement interval* and the number of times the phone interacts with the NHS3100 demonstrator before reconfiguring the NHS3100 IC.

If you want to test the NHS3100 demonstrator for an extended period, ensure *Limit count* is unchecked.

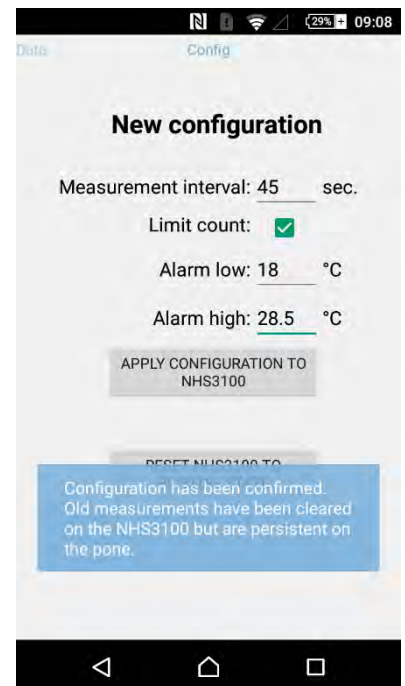


Figure 12: Config screen with a confirmation message received from NHS3100 after reconfiguring the demo PCB

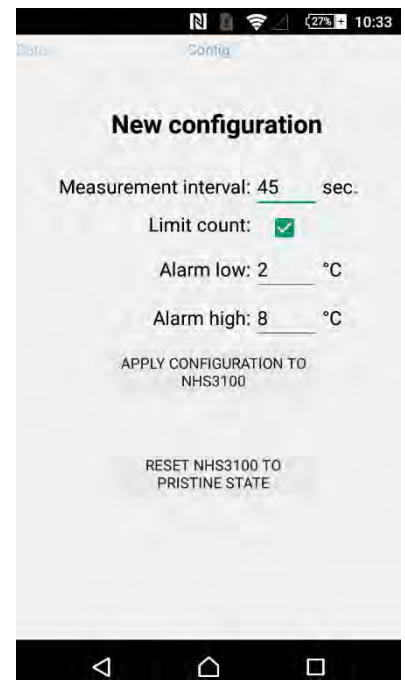


Figure 13: Config screen with greyed out buttons to indicate no NHS3100 is held close

*Note:* The logic that determines when to stop taking measurements – only when option *Limit count* is checked – is as follows:

- Take at least 42 samples and at most 1024 samples.
  - With that range, run for half an hour. Run longer if necessary to attain the minimum count; run shorter if the maximum count is already attained.
  - Both the count and the time are reset if a phone is brought near when the stop conditions were not met.
3. The *Alarm low* and *Alarm high* thresholds are optional. When left blank, or when the range is empty, all samples are considered within an acceptable range.
  4. Pressing the *Apply* sends the configuration to the NHS3100 IC. A confirmation message is returned when the configuration is accepted. Setting a new configuration also clears all measurement values from its internal storage. The phone however retains all measurement data that have been fetched. This new configuration goes into effect once the NFC field is removed from the NHS3100 demonstrator.
  5. The *Reset* button is a quick way to send a configuration with reset values to the NHS3100 IC. This action also removes all previously fetched data about the tag on the phone itself.

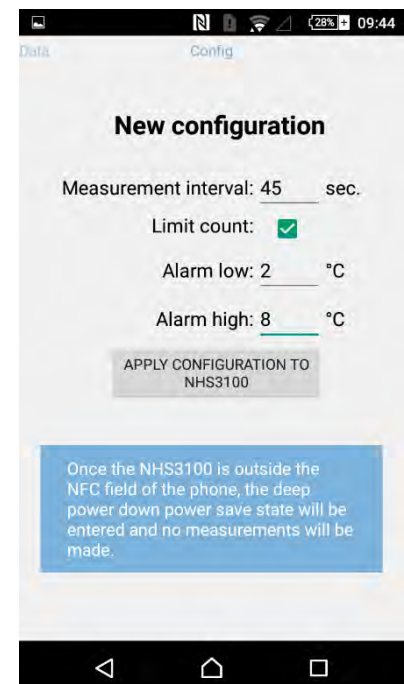


Figure 14: Config screen with a notification after resetting to pristine state

## Troubleshooting

What to do if...

### *The tag is not recognized at all*

- *Is the NFC functionality on the phone enabled?* If it is not enabled, enable it. If it is, try disabling and re-enabling it.
- *Is the tag positioned correctly?* Move the tag slowly over the back of the phone from top to bottom until you find the location of the NFC antenna on the phone. Some phones depict an NFC logo on the back to help you aiming correctly.
- *Is the tag distance optimal?* On most phones, touching the tag with the phone yields the best results; on other phones it is better to maintain a small distance. The maximum distance you can expect to reach is about 5 cm.
- *Is the battery voltage level still sufficient?* Battery voltage should be greater than 1.72 V. Check or replace the battery, and retry.

### *The tag is recognized, but the measurement values are not read out*

- *Is it recognized as an NHS3100 tag?* Pay close attention to the notifications that briefly pop-up to know whether the tag is correctly recognized as an NHS3100. If not, the IC might not have the correct temperature logger application flashed.
- *Is the tag empty?* Pay close attention to the notifications that pop-up when the tag is touched. The number of available measurement values available is also given. You can also check the *Status screen* to know what's inside.
- *Is the connection already lost?* The phone must have a continuous connection, or communication halts and must be restarted: move the tag away and then back in range with the phone again. Pay close attention to the notifications that pop-up to know the current state of the communication between tag and reader.

### *The connection is not stable*

- *Is the tag held in a fixed position?* The phone's connection with the tag must be maintained continuously: try to minimize the movements of the tag relative to the phone.

### *Reporting*

- When problems persist, or when this manual fails to clarify behavior, please report the matter to us. Reporting to us helps us to help you, and helps to improve the demo and the underlying software.
- Be sure to include the demo PCB HW number and phone details such as manufacturer, model and OS version.





## Next steps

For more information about this demonstration or NHS3100 please email us at [nhs-info@nxp.com](mailto:nhs-info@nxp.com)

For technical support, please email us at [nhs-support@nxp.com](mailto:nhs-support@nxp.com)

We wish you every success,  
*the NHS3100 team*

*This product and the accompanying app are a demonstration. By using this demonstration HW and SW, you understand, agree and acknowledge that this NHS3100 Temperature Logger App:*

- *May only be used in strict compliance with the terms and conditions laid down in the NHS3100 Temperature Logger Software Evaluation License Agreement.*
- *Can only be used for evaluation and demonstration of NHS3100 based demonstration temperature loggers.*
- *The app, together with the NHS3100 demonstration hardware, is not intended for use in or use in combination with medical devices and/or medicinal products and it should not be used for fit-for-use decisions of temperature sensitive materials.*

# Evaluation License Agreement

This Evaluation License Agreement (the “Agreement”) is entered into electronically as of the date of installation of the NHS3100 Temperature Logging App (the “Effective Date”) by and between NXP Semiconductors Belgium N.V. having its principal place of business at Interleuvenlaan 80, 3001 Leuven, Belgium (hereinafter referred to as “NXP”) and the user who successfully downloaded and installed the NHS3100 Temperature Logging App (hereinafter: “Licensee”).

Whereas, it is beneficial to NXP to enable prospective customers, analysts and test labs to evaluate NXP's NHS3100 hardware as specified in Exhibit A below, by making use of the NHS3100 Temperature Logging App; and

Whereas, it is beneficial for the Licensee to be able to evaluate NXP's NHS3100 hardware with the NHS3100 Temperature Logging App. The NHS3100 Temperature Logging App as downloaded and installed by Licensee and related documentation are hereinafter collectively referred to as: “Software”;

Now therefore, the parties agree as follows:

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6. Product Maintenance
- NXP is not obligated to provide maintenance or updates to Licensee for the Software. However, any maintenance or updates provided voluntarily by NXP shall be covered by this Agreement.
7. General
- A) The validity, performance and construction of this Agreement shall be governed by the laws of Belgium without regard to provisions concerning conflicts of laws. The parties consent to the jurisdiction and venue of the competent courts of Leuven, Belgium, for all disputes or litigation arising under this Agreement; provided, however, that each party may enforce its or its affiliates' trade secret and other intellectual property rights in any court of competent jurisdiction, including but not limited to injunctive relief.
  - B) The prevailing party in any legal action arising out of, or related to, this Agreement shall be entitled, in addition to any other rights and remedies it may have, to reimbursement for its expenses incurred in such action, including court costs and reasonable attorney's fees.
  - C) Licensee acknowledges that if NXP is required to bring an action to enforce the provisions of this Agreement, the damages may be irreparable and difficult to measure and that NXP shall be entitled to seek equitable relief including a preliminary injunction in addition to any other relief available. Licensee agrees that in the event that NXP seeks an injunction hereunder, Licensee hereby waives any requirement for the posting of a bond or any other security.

- D) Insofar as these relate to the activities under this Agreement, Licensee will comply with all applicable export and import control laws and regulations and, in particular, will not export or re-export the Software, or any portion thereof, or documentation pertaining thereto, without all required national and international government licenses, approvals, or waivers. Licensee agrees that it will not knowingly transfer, divert, export or re-export, directly or indirectly, any product, hardware, software, including software source code, or technical data restricted by such regulations or by other applicable national regulations, received from NXP under this Agreement, or any direct product of such hardware, software or technical data to any person, firm, entity country or destination to which such transfer, diversion, export or re-export is restricted or prohibited by applicable law, without obtaining prior authorization from the applicable competent government authorities to the extent required by those laws. This provision shall survive termination or expiration of this Agreement.
- E) The terms and conditions of this Agreement may not be superseded, modified, or amended except in writing which states that it is such a modification, and is signed by an authorized representative of each party hereto.
- F) This Agreement, including exhibits, constitutes the entire Agreement between the parties as to the subject matter hereof, and supersedes and replaces all prior or contemporaneous agreements, written or oral, regarding such subject matter, and shall take precedence over any additional or conflicting terms which may be contained in either party's purchase orders or order acknowledgment forms.

## Exhibit A

This app supports the following NHS3100 based demonstrations:

- Flexfoil with the NHS3100, printed NFC antenna and the printed battery
- Demonstration PCB with the NHS3100, an NFC antenna and a coin cell battery.
- PCBs and/or flexfoils developed by third parties in agreement with NXP and using the NHS3100 demonstration firmware as delivered by NXP.

