Basic technical information for NeoTAG® HF transponders, Document 4 of 4

Our product range of NeoTAG® HF RFID transponders/ RFID chips is constantly being expanded and new transponder versions are regularly added. In connection with the use of our transponders, we have compiled a large amount of background information on mounting, function, design, operating behaviour, etc. due to the many applications in which the products are used. As a supplement to our Product Information HF RFID Transponder data sheet, this document contains further technical explanations and application-supporting information.

1. General environmental tests

Extensive environmental and temperature tests have been carried out on NEOSID transponders of the NeoTAG® Inlay and NeoTAG® Plug types. In doing so, we follow the AEC-Q200 quality standard. The AEC-Q200 is a global standard of the Automotive Electronics Council for testing the stress resistance of passive electronic components.

The following environmental tests were carried out:

Test	Reference/Standard	Parameter	Test samples
Humidity	MIL-STD-202 Method 106	10 cycles of 24 h at 90 – 100 % RH and temp. changes +25° C to +65° C	77
Temperature shock	MIL-STD-202 Method 107	300 cycles rapid temperature changes (< 20 s) -40° C to +150° C	30
Ultrasonic bath	NEOSID internal	15 min. at 60° C in distilled water	15
Drop test	NEOSID internal	100 cycles from 2 m height onto concrete	20

After the test parameters and cycles, the specified read and write capability was confirmed for all tested transponders!

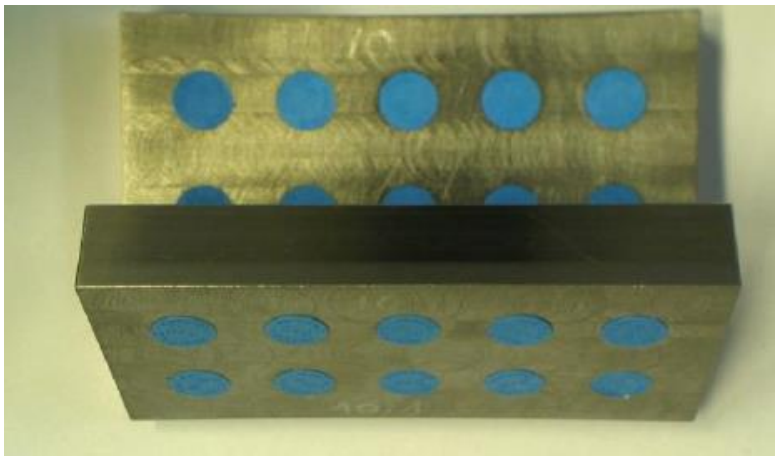
2. Temperature load of the transponders

The NeoTAG® transponders were developed to withstand use in harsh environmental conditions. High temperature stability has been achieved through the design and selection of high quality components. A winding of temperature-resistant ferrite material ensures the transponder antenna's dimensional stability under adverse conditions, resulting in mechanical and electrical properties with very low tolerances.

In the course of internal temperature tests, the transponders were checked for their suitability. The following tests at high ambient temperatures were carried out in our laboratory:

Test	Settings	No. test samples
Temperatur Test	122 h at 150° C	30
Temperatur Test	100 h at 180° C	30
Temperatur Test	5 h at +200° C	30
Temperatur Test	2 h at +220° C	30
Temperatur Test	Max. 15 min. at +275° C	30

The temperature tests were carried out with NeoTAG® plug transponders which were pressed into a steel block. This simulates a typical installation of the transponders.



After the test, all tested transponders could be read out without any problems!

3. Rapid temperature changes

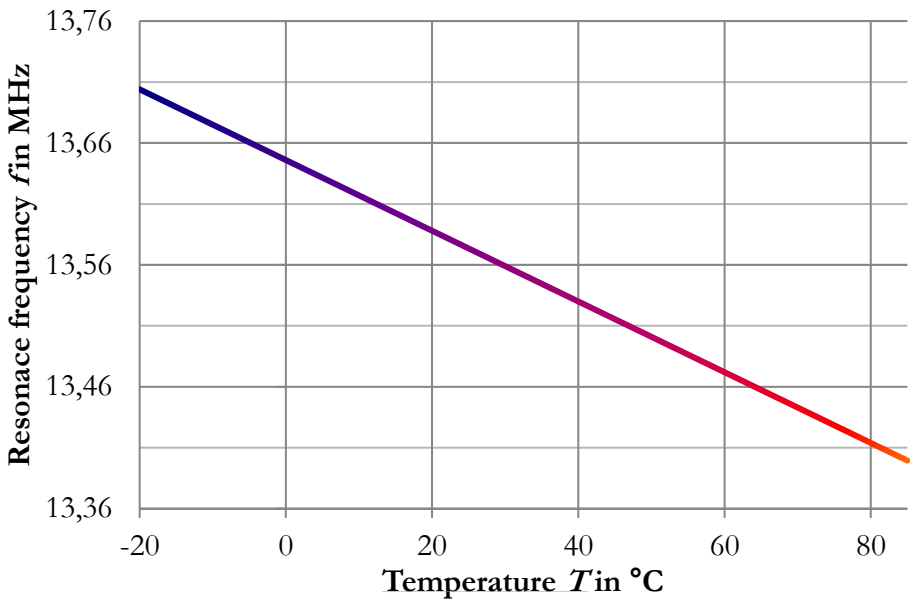
An identical test set-up as under 2. was used for tests with rapid temperature changes. The transponders were exposed to temperature changes between -40° C and +150° C. The cycle time was < 20 s.

In total, 300 cycles were completed.

After the test, all tested transponders could be read out without any problems!

4. Temperature drift of the resonance frequency

With changing the ambient temperature, there are deviations in the natural resonance frequency of the RFID transponders. These result from the temperature coefficients of the components used.



The typical resonance frequency of 13.56 MHz occurs at room temperature. The resonance frequency increases with lower temperatures. With higher temperatures, the resonance frequency drops.

The temperature coefficient of this change is approx. -3 kHz per Kelvin.

The specified temperature range for erase, read and write operations is -40° C to +85° C.

5. Data retention time of the IC memory

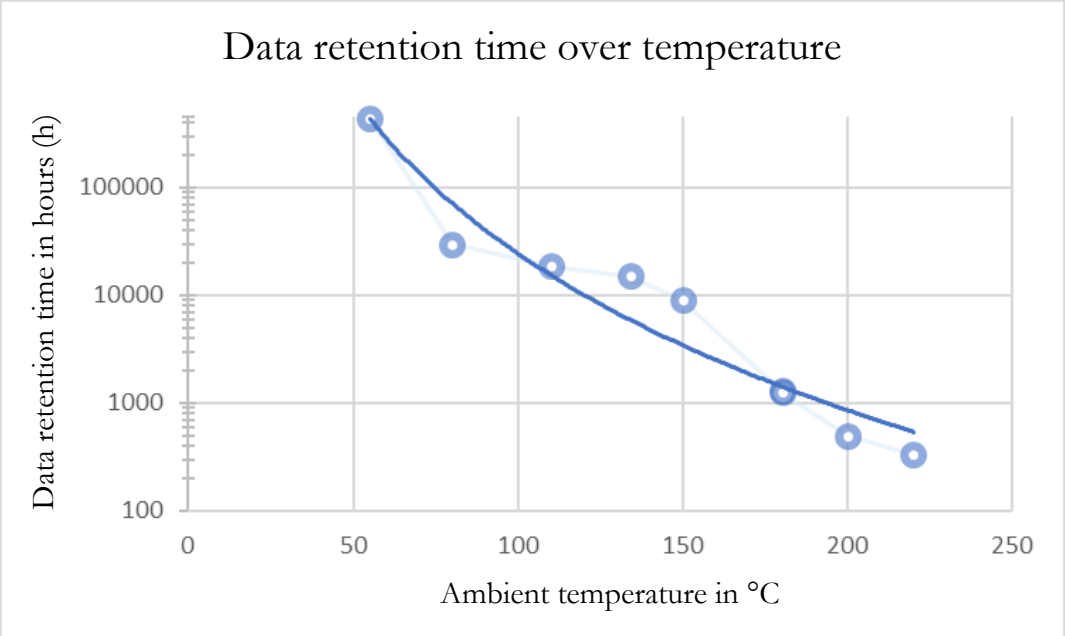
Each RFID IC has a limited amount of data memory in which digital information is stored. The unique identifier (UID) of each RFID chip is programmed into the memory, e.g. by the manufacturer of the IC. This ensures that there is no second transponder that carries an identical UID. In addition, the UID provides information about the manufacturer and the type of RFID IC used. This information is stored unchangeably in the IC.

In addition to the UID, most RFID ICs have a further memory area that the user can program as desired for his application (user memory).

All memory blocks in the semiconductor are subject to ageing. The manufacturers of RFID ICs specify the data retention time in the data sheet, e.g. 50 years at a maximum of +55° C (data retention time). Ageing is accelerated as soon as the RFID IC is exposed to higher ambient temperatures than the maximum temperature specified for this parameter.

Since our RFID transponders are frequently exposed to ambient temperatures of more than +55° C in their application, it is of great interest to know to which value the data retention time is reduced in the respective application.

The temperature dependence of the data retention time can be described by the following characteristic curve:



There is usually no clear information from the RFID IC manufacturers on the data retention time when the specified temperature of +55° C is exceeded. The information we provide on the data retention time is based on internal investigations in which our transponders are used at increased ambient temperatures and on technical statements by the chip manufacturers. The values stated are guide values and serve as orientation.

We have compiled the following application examples. After completing the number of cycles mentioned, the data retention of the memory cell can theoretically be exhausted:

- 1,5 h @ +80° C after 20000 cycles
- 1,5 h @ +110° C after 12500 cycles
- 1,5 h @ +134° C after 10000 cycles
- 1,5 h @ +150° C after 6000 cycles
- 1,5 h @ +180° C after 870 cycles
- 90 h @ +180° C after 14 cycles
- 5 h @ +200° C after 100 Zyklen
- 2 h @ +220° C after 167 cycles

After the data retention time has expired, changes may occur in the contents of the semiconductor memory cells. To prevent data loss, the data retention time should be observed in the use of the RFID transponder.

6. IPx7/IPx8 protection type test

77 pieces each of NeoTAG® Inlay and NeoTAG® Plug transponders were subjected to IPx7 protection type testing. The test criteria included storing the transponder in a water depth of up to 1 m for a period of min. 30 minutes. The storage time was extended to 60 minutes.

After the test, all tested transponders could be read out without any problems!

Furthermore, 20 transponders of the type NeoTAG® Plug were tested in an external laboratory to IPx8 according to DIN EN 60529. No changes to the TAG could be detected.

After the test, all tested transponders could be read out without any problems!

7. Water storage test

77 pieces each of NeoTAG® Inlay and NeoTAG® Plug were stored in a container filled with water for 37 days. The weekly measuring intervals showed no change in the TAG.

After the test, all tested transponders could be read out without any problems!

This product information is one of four documents summarising special features, design notes and mounting information for our HF transponders of the NeoTAG family. The following features are explained with the documents:

Product info 1 of 4:	-	Nomenclature
	-	Weights and dimensions
Product info 2 of 4:	-	Reading ranges
	-	Metallic environments
	-	Read duration
	-	TAG alignment
Product info 3 of 4:	-	Mounting
	-	Mechanical stress
Product info 4 von 4:	**-**	**Environmental tests**
	-	**Temperature resistance**

Tell us your requirements - we will develop the right solution for you.

Have we aroused your interest? Then contact us about RFID transponders for different frequency ranges. Customised solutions are our speciality. We will be happy to support you with our know-how to realise your product development.

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