Enlarged frequency range for TLE4922

Guideline for application up to 25kHz frequency range

Scope and purpose

TLE4922 is a well established general purpose speed sensor for industrial and automotive 2 wheeler applications.

This document is addressing the wide range of industrial and automotive applications which need higher frequency range as the specified 8kHz. A special focus is asynchronous motor using a speed sensor for commuting the motor.

Intended audience

System designer for asynchronous drives and other high frequency applications with the need of a speed sensor.

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1 Border conditions and measurement setup

To give guidance how the TLE4922 will typically operate at a frequency range out of datasheet specification (8kHz as stated in V1.0 from November 2016) Infineon provides typical measurement results in this document.

1.1 Border conditions

Automotive temperature range up to 150°C

Frequency range up to 25kHz tooth frequency

Air gap range of 1.0mm to 2.0mm (surface of sensor to surface of toothed wheel)

Magnet on the back of the sensor. Material can be Fe, NdFeB or SmCo.

1.2 Setup

As the Infineon testbench is capable of 10000rpm only a special wheel was manufactured with 162 teeth along its circumfence:

Figure 1 Wheel spinning at 9260 rpm to achieve 25kHz teeth frequency

Further details on the wheel:

- Maximum diameter: 310mm
- Number of teeth: 162
- Width of tooth: 2.5mm
- Width of slot (notch): 3.5mm

Border conditions and measurement setup

Details on the used back bias magnet mounted on the back of TLE4922:

- Diameter: 6mm
- Heigth: 4mm
- Material: NdFeB
- Order number at RS-components: 724-3875
- Measured flux density in 0.5mm distance above surface (position of sensing element of TLE4922): approximately 300mT

Measured datapoints:

- 3 temperatures: -40°C / 25°C / 125°C (150°C was not possible as toothed wheel acts like a fan)
- 8 frequencies: 1kHz / 2kHz / 5kHz / 8kHz / 10kHz / 15kHz / 20kHz / 25kHz
- 3 air gaps: 1.0mm / 1.5mm / 2.0mm

By an automated process the module is positioned in various air gaps and the wheel is spinned at various speeds. A high precision angular encoder is recognizing the exact position/angle of the wheel. For the jitter calculation the standard deviation (3 sigma value) over 1000 revolutions is calculated.

2 Captured results

The first scan was done for maximum air gap performance. The result is pictured in Figure 2.

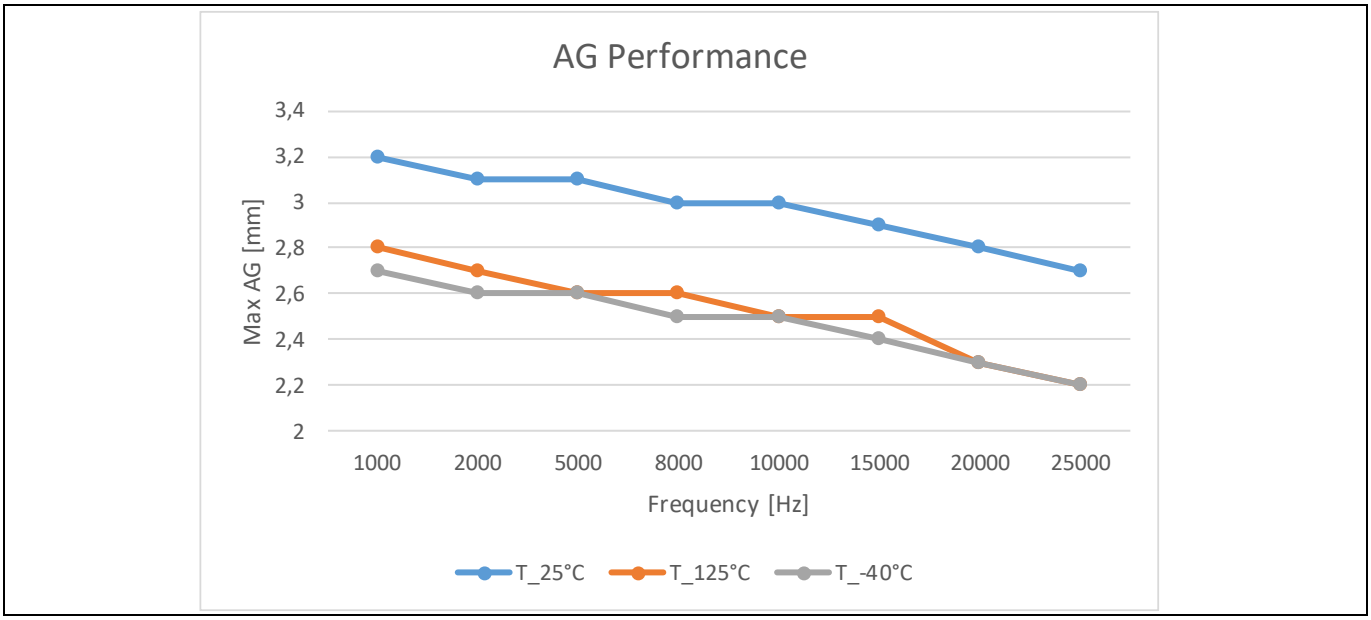

Figure 2 Maximum air gap performance of TLE4922 over frequency

There is a clear dependency on the maximum frequency. Whereas at 10kHz a maximum air gap of 2.5mm is possible, the maximum air gap will decrease to 2.2mm at 25kHz.

In the case of a stronger back bias magnet the maximum air gap can be increased by about 0.3mm.

Looking into details on repeatability figures 3 to 5 show the jitter performance at different air gaps.

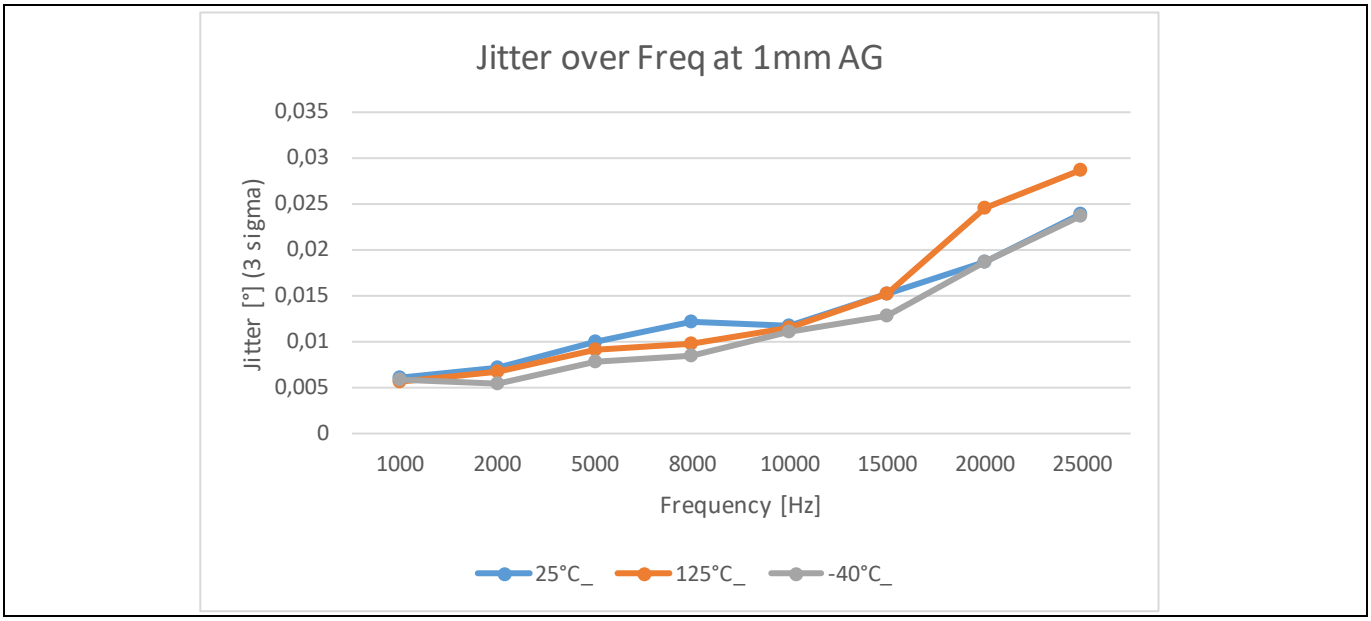

Figure 3 Repeatability at 1mm air gap over frequency

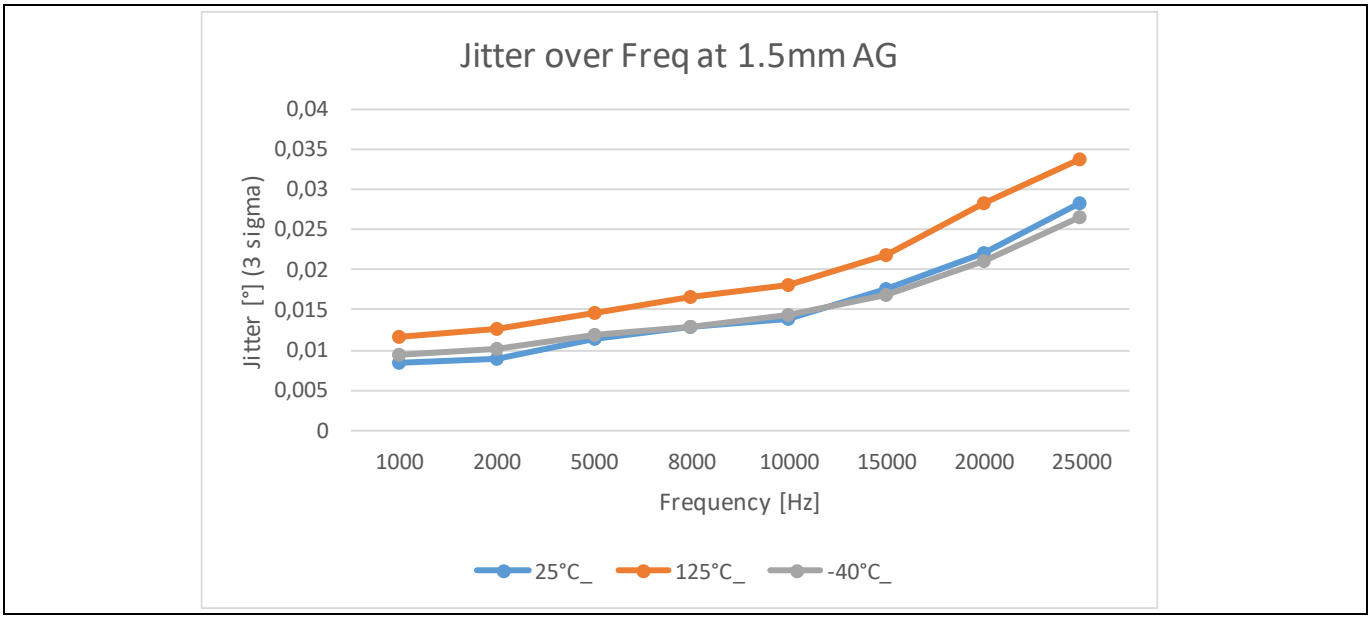

Figure 4 Repeatability at 1.5mm air gap over frequency

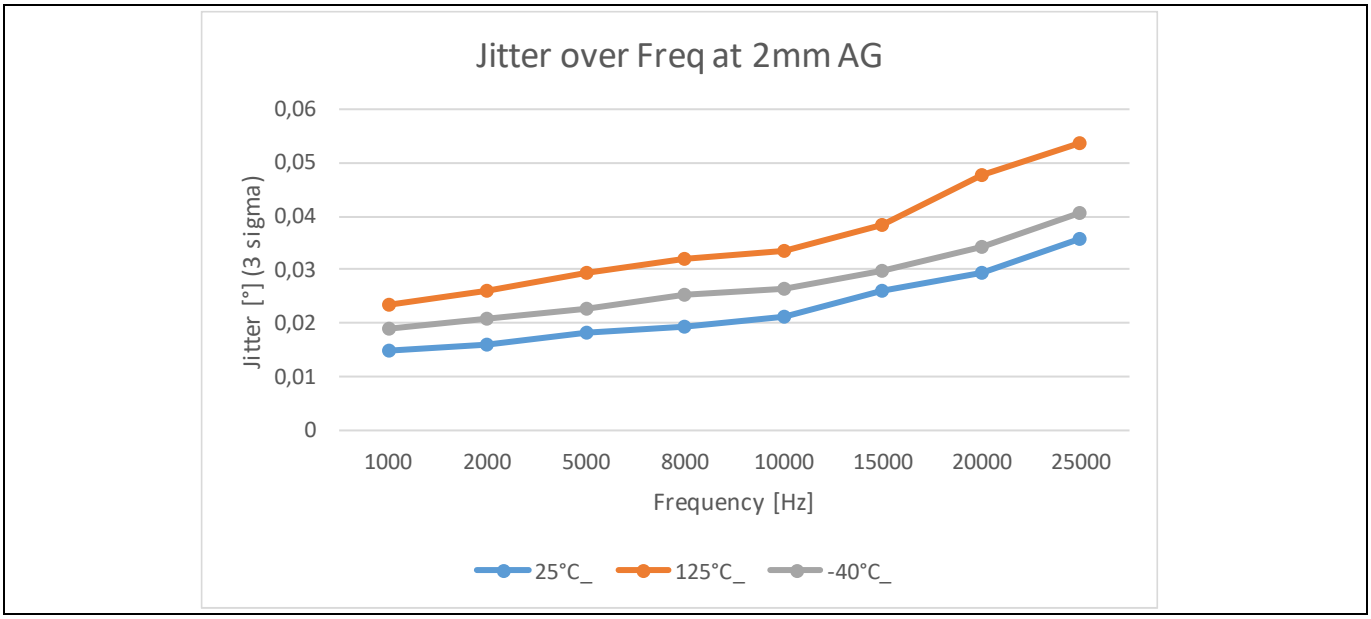

Figure 5 Repeatability at 2mm air gap over frequency

Of course the worst case is at high temperature and at high frequency. The provided three charts give an indication on TYPICAL behavior and help to decide for maximum frequency and maximum temperature to get the needed jitter performance.

Revision history

Document version	Date of release	Description of changes
V 1.0	2020-03-28	Initial version

2020-03-26

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