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TLE4998S8(D)

High Performance Programmable Single/Dual Linear Hall Sensor

Data Sheet

Revision 1.1, 2017-01

Sense & Control

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Edition 2017-01

Published by
Infineon Technologies AG
81726 Munich, Germany

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1 Overview

Characteristic	Supply Voltage	Supply Current	Magnetic Range	Interface	Temperature
Programmable Single/Dual Die Linear Hall Sensor	4.5~5.5 V	6 mA	±50mT ±100mT ±200mT	SENT (Single Edge Nibble Transmission) Open Drain Output	-40°C to 125°C

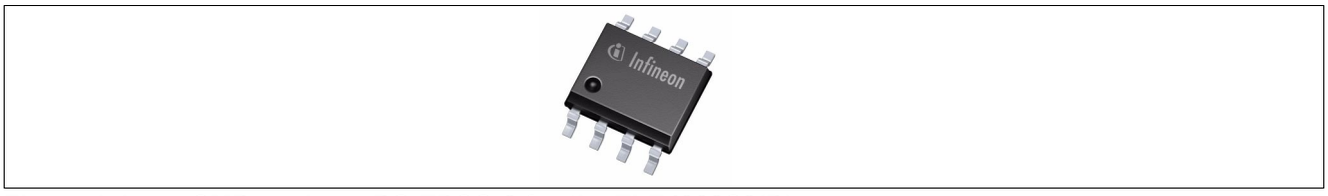


Figure 1-1 SMD package PG-TDSO-8 for the TLE4998S8(D)

1.1 Features

- Integration of two individual Linear Hall sensor IC's with Single Edge Nibble Transmission (SENT) open-drain output signal (SAE J2716)
- 20-bit Digital Signal Processing (DSP)
- Digital temperature and stress compensation
- 16-bit overall resolution
- Operating automotive temperature range -40°C to 125°C
- Minimal drift of output signal over temperature and lifetime
- Programmable parameters stored in EEPROM with single-bit error correction:
  - SENT unit time
  - Magnetic range, sensitivity (gain), offset, and polarity of the output slope
  - Filter Bandwidth
  - Clamping levels
  - Customer temperature compensation coefficients for all common magnets
- Re-programmable until memory lock
- Supply voltage 4.5-5.5 V (4.1-16 V extended range)
- Configurable magnetic range: ±50 mT, ±100 mT, or ±200 mT
- Reverse-polarity and overvoltage protection for all pins
- Output short-circuit protection
- On-board diagnostics (overvoltage, EEPROM error)
- Output of internal magnetic field values and temperature
- Programming and operation of multiple sensors with common power supply
- Two-point calibration of magnetic transfer function without iteration steps

Note: Product qualification is based on "AEC Q100 Rev. G" grade 1 (Automotive Electronics Council - Stress test qualification for integrated circuits)

Table 1-1 Ordering Information

Product Name	Marking	Ordering Code	Package
TLE4998S8	S8S	SP000902780	single sensor, PG-TDSO-8-1
TLE4998S8D	S8D	SP000902784	dual sensor, PG-TDSO-8-2

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1.2 Target Applications

- Robust replacement of potentiometers: No mechanical abrasion, resistant to humidity, temperature, pollution and vibration
- Linear and angular position sensing in automotive and industrial applications with highest accuracy requirements
- Suited for safety applications such as pedal position, throttle position and steering torque sensing

1.3 Pin Configuration

Figure 1-2 shows the location of the Hall elements in the package and the pin configuration of the TLE4998S8(D).

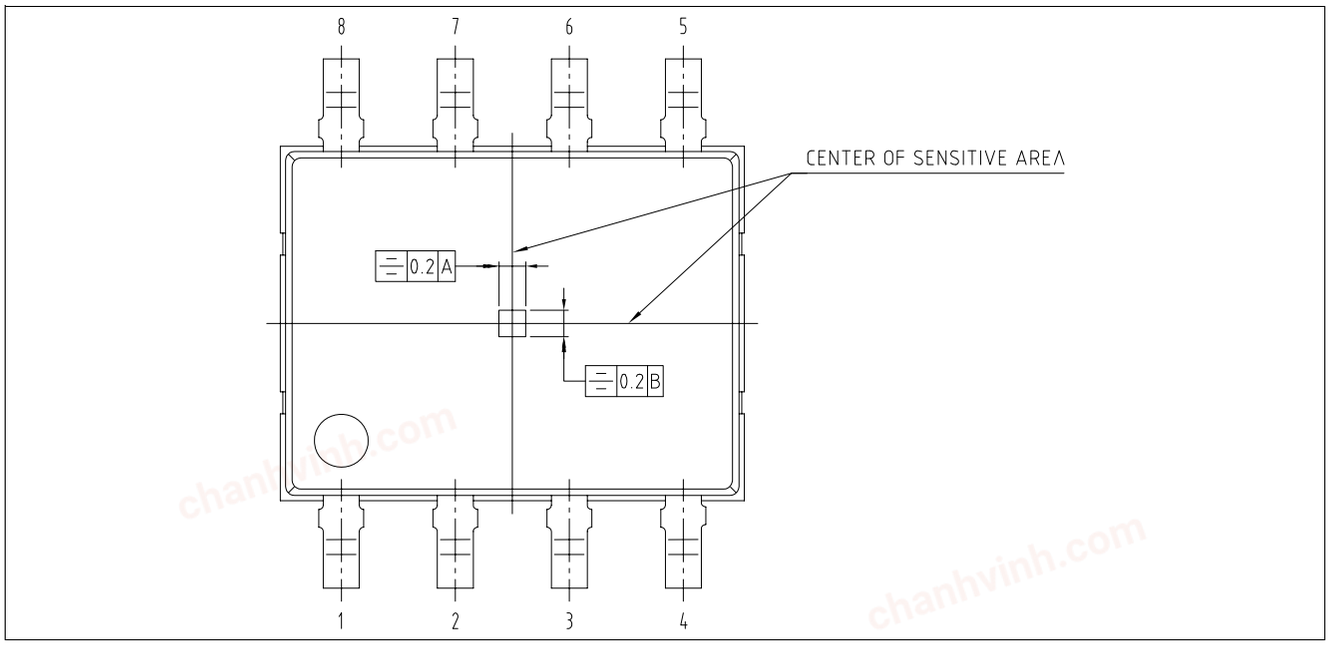


Figure 1-2 Pin Configuration of PG-TDSO-8 package

Table 1-2 TLE4998S8(D) Pin Definitions and Functions

Pin No.	Symbol	TLE4998S8 Function	TLE4998S8D Function
1	TST	Test pin (connection to GND is recommended)	Test pin (top die, connection to GND is recommended)
2	V_{DD}	Supply voltage / programming interface	Supply voltage / programming interface (top die)
3	GND	Ground	Ground (top die)
4	OUT	Output / programming interface	Output / programming interface (top die)
5	OUT	Not connected	Output / programming interface (bottom die)
6	GND	Not connected	Ground (bottom die)
7	V_{DD}	Not connected	Supply voltage / programming interface (bottom die)
8	TST	Not connected	Test pin (bottom die, connection to GND is recommended)

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2 General

All further given specifications are regarded to both implemented sensor IC's, or otherwise noted.

2.1 Block Diagram

Figure 2-1 shows is a simplified block diagram.

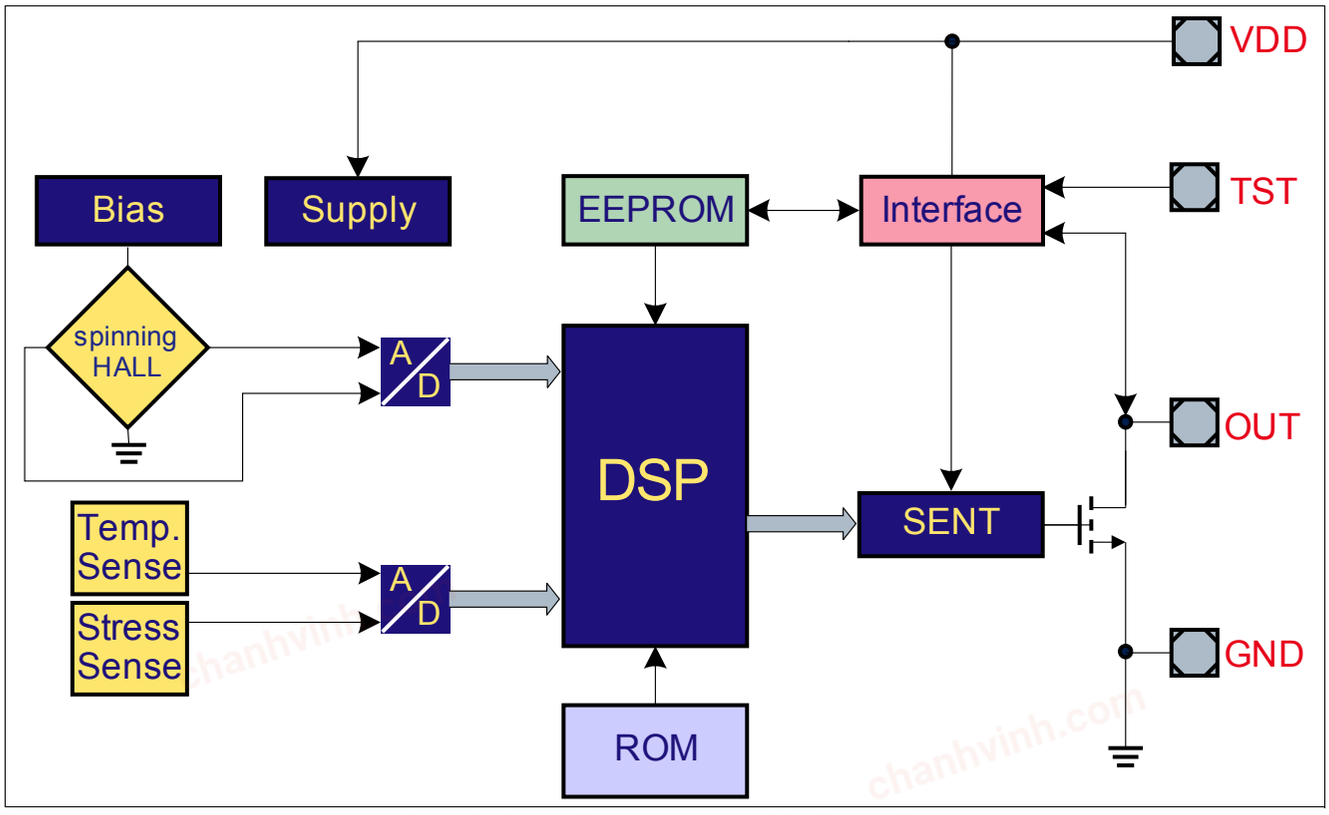


Figure 2-1 Block Diagram of the TLE4998S8(D) with the SENT interface

2.2 Functional Description

The linear Hall IC TLE4998S8(D) has been designed specifically to meet the requirements of highly accurate angle and position detection.

The sensor provides a digital SENT signal based on the SAE J2716 standard, which consists of a sequence of pulses. Each transmission consists of multiple data nibbles containing the Hall value, the temperature and status information of the sensor.

The output stage is an open-drain driver pulling the output pin to low only. Therefore, the high level needs to be obtained by an external pull-up resistor. This output type has the advantage that the receiver may use an even lower supply voltage (e.g. 3.3 V). In this case the pull-up resistor must be connected to the given receiver supply.

The IC is produced in BiCMOS technology with high voltage capability and it also has reverse-polarity protection.

Digital signal processing using a 16-bit DSP architecture together with digital temperature and stress compensation guarantees excellent stability over the whole temperature range and life time.

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2.3 Principle of Operation

- A magnetic flux is measured by a Hall-effect cell
- The output signal from the Hall-effect cell is converted from analog to digital signals
- The chopped Hall-effect cell and continuous-time A/D conversion ensure a very low and stable magnetic offset
- A programmable low-pass filter to reduce noise
- The temperature is measured and A/D converted
- Temperature compensation is done digitally using a second-order function
- Digital processing of the output value is based on zero field and sensitivity value
- The output value range can be clamped by digital limiters
- The final output value is represented by the data nibbles of the SENT protocol

2.4 Transfer Functions

The examples in **Figure 2-2** show how different magnetic field ranges can be mapped to the desired output value ranges.

- Polarity Mode:
  - **Bipolar**: Magnetic fields can be measured in both orientations. The limit points do not necessarily have to be symmetrical around the zero field point
  - **Unipolar**: Only north- or south-oriented magnetic fields are measured
- Inversion: Both gain can be set to positive values, negative values or positive/negative values.

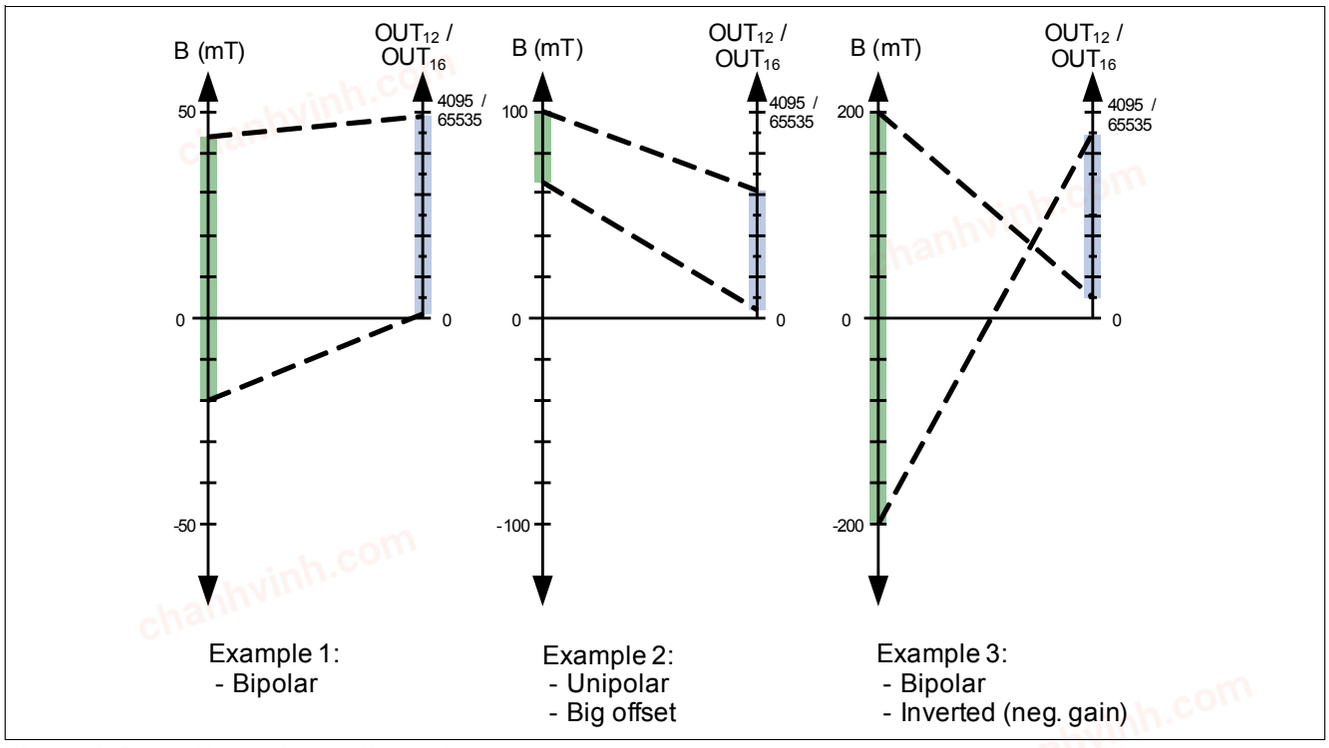


Figure 2-2 Examples of Operation

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3 Maximum Ratings

All further given specifications are regarded to each of the implemented sensors IC's, or otherwise noted.

Table 3-1 Absolute Maximum Ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Junction temperature	T_J	- 40	–	160[1)]	°C	–
Voltage on V_{DD} pin with respect to ground	V_{DD}	-18	–	18.35	V	2)3)
Supply current @ overvoltage V_{DD} max.	I_{DDov}	–	–	15	mA	–
Reverse supply current @ V_{DD} min.	I_{DDrev}	-1	–	0	mA	–
Voltage on output pin with respect to ground	V_{OUT}	-1[4)]	–	18.35[5)]	V	–
Magnetic field	B_{MAX}	-	–	1	T	–
ESD protection	V_{ESD}	–	–	±2	kV	According HBM ANSI/ESDA/JEDEC JS-001

1) For limited time of 96 h. Depends on customer temperature lifetime cycles. Please aks Infineon for support.

2) Higher voltage stress than absolute maximum rating, e.g. 150% in latch-up tests is not applicable. In such cases, R_{series} ≥100 Ω for current limitation is required.

3) Max 1h, in operating temperature range.

4) I_{DD} can exceed 10 mA when the voltage on OUT is pulled below -1 V (-5 V at room temperature).

5) V_{DD} = 5 V, open drain permanent low, for max. 10 minutes

Attention: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Furthermore, only single error cases are assumed. More than one stress/error case may also damage the device.
Exposure to absolute maximum rating conditions for extended periods may affect device reliability. During absolute maximum rating overload conditions the voltage on VDD pins with respect to ground (VSS) must not exceed the values defined by the absolute maximum ratings.

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4 Operating Range

The following operating conditions must not be exceeded in order to ensure correct operation of the TLE4998S8(D). All parameters specified in the following sections refer to these operating conditions and each of the implemented sensors IC's if applicable or unless otherwise indicated.

Table 4-1 Operating Range

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{DD}	4.5	–	5.5	V	–
		4.1	–	16[1)2)]	V	Extended range
Supply undervoltage	V_{DDuv}	V_{DDpon}[3)]	–	4.1	V	Undervoltage range, reduced magnetic performance (see Table 5-3)
Output pull-up voltage[4)]	$V_{pull-up}$	–	–	18.35	V	–
Load resistance[4)]	R_L	1	–	–	kΩ	–
Output current[4)]	I_{out}	0	–	5	mA	–
Load capacitance[4)]	C_L	1	–	8	nF	–
Ambient temperature[5)]	T_A	-40	–	125	°C	max. 1200 h at 125°C[6)]

1) For supply voltages > 12 V, a series resistance R_{series} ≥100 Ω is recommended
2) The open drain switch off, due to overvoltage on the V_{DD} line, can take place in the range of 16.65 V to 18.35 V, as defined in Chapter 9.1 of the data sheet.
3) V_{DDpon} ... power-on reset level, see Table 5-1
4) Output protocol characteristics depend on these parameters, R_L must be according to max. output current
5) R_{THja} ≤ 150 K/W.
6) Maximum exposure time at other ambient temperatures between -40°C and 125°C shall be calculated based on the values specified in this table using the Arrhenius model.

Note: Keeping signal levels within the limits specified in this table ensures operation without overload conditions.

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5 Electrical, Thermal and Magnetic Parameters

All specification values are valid over temperature and lifetime, unless noted otherwise.

5.1 Electrical Characteristics

Table 5-1 Electrical Characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply current	I_{DD}	3	6	8	mA	per die
Thermal resistance[1]	R_{thJA}	–	150	–	K/W	junction to air
	R_{thJC}	–	85	–	K/W	junction to case
Power-on time[2]	t_{Pon}	–	0.7	2	ms	≤ ±5% target out value
		–	15	20		≤ ±1% target out value
Power-on reset level[3]	V_{DDpon}	3.1	3.5	3.9	V	
Output impedance	Z_{OUT}	20	40	70	kΩ	
Output fall time	t_{fall}	2	3.5	5	µs	V_{OUT} 4.5 V to 0.5 V[4]
Output rise time	t_{rise}	–	20	–	µs	V_{OUT} 0.5 V to 4.5 V[4]
Output low saturation voltage	V_{OUTsat}	–	0.3	0.6	V	$I_{OUTsink}$= 5 mA
		–	0.2	0.4	V	$I_{OUTsink}$= 2.2 mA
Output noise (rms)	OUT_{noise}	–	–	2	LSB_{12}	With LP filter setting, from 80 Hz until 1390 Hz[5]
Oscillator frequency variation	Δf / f	-20	–	20	%	Nominal oscillator frequency: 8MHz

1) Values derived from a simulation with a 4-layer PCB
2) Response time to set up output data at power on when a constant field is applied. The first value given has a ±5% error, the second value has a ±1% error.
3) Power-on and power-off
4) Depends on External R_L and C_L, See **Figure 5-1**
5) Range ±50 mT (also valid for ranges ±100 mT and ±200 mT), Gain 1.0 (scales linearly with gain)

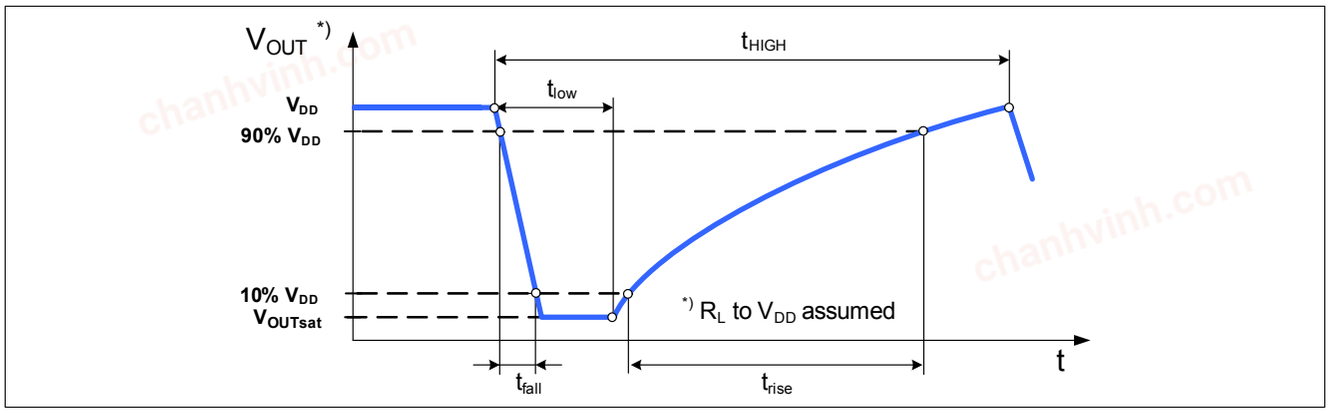


Figure 5-1 Output Characteristic

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Calculation of the Junction Temperature

The internal power dissipation P_{TOT} of the sensor increases the chip junction temperature above the ambient temperature.

The power multiplied by the total thermal resistance R_{thJA} (Junction to Ambient) added to T_A leads to the final junction temperature. R_{thJA} is the sum of the addition of the two components, Junction to Case and Case to Ambient.

$R_{thJA} = R_{thJC} + R_{thCA}$

$T_J = T_A + \Delta T = R_{thJA} \times P_{TOT} = R_{thJA} \times (V_{DD} \times I_{DD} + V_{OUT} \times I_{OUT})$; I_{DD}, $I_{OUT} > 0$, if direction is into IC

Example (assuming no load on V_{OUT} and TLE4998S8(D) type):

- V_{DD} = 5 V
- I_{DD} = 8 mA
- ΔT= 150[K/W] x (5 [V] x 0.008 [A] + 0 [VA]) = 6 K per silicon

For molded sensors, the calculation with R_{thJC} is more adequate.

5.2 Magnetic Characteristics

Table 5-2 Magnetic Characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Sensitivity	S[1)]	±8.2	–	±245	LSB_{12}/mT	programmable[2)]
Sensitivity drift	ΔS	-2.0	–	+2.0	%	
Magnetic field range	MFR	±50	±100	±200	mT	programmable[3)4)]
Integral nonlinearity	INL	–	±2.0	±4.1	LSB_{12}	[5)]
Magnetic offset	B_{OS}	–	-	±400	µT	Error band[6)]
Magnetic offset drift	ΔB_{OS}	–	±1	±5	µT/°C	
Magnetic hysteresis	B_{HYS}	–	–	20 10	µT	in 50mT range in 100mT range

1) Defined as ΔOUT / ΔB.
2) Programmable in steps of 0.024%.
3) Depending on offset and gain settings, the output may already be saturated at lower fields.
4) The sensor offset is trimmed during production. The offset register is set to 50% and the offset is tested at room temperature. Maximum tolerance is ±0,3%=±197LSB from the full output range (16bit) of the digital register DOUT.
5) Range ±50 mT (also valid for ranges ±100 mT and ±200 mT), Gain = 1.0 (scales linearly with gain).
6) In operating temperature range and over lifetime, in 50mT range.

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5.3 Electrical and Magnetic Characteristics in Undervoltage Range

Table 5-3 Electrical and Magnetic Characteristics in Supply Undervoltage Range

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Sensitivity drift	$S_{E(T)}$	–	–	+2.5/-7.5	%	
Magnetic offset drift	ΔB_{OS}	–	–	±400	µT	
Integral nonlinearity	INL	–	–	±8.2	LSB_{12}	1)
Output noise (rms)	OUT_{noise}	–	–	8	LSB_{12}	With LP filter setting, from 80 Hz until 1390 Hz1)

1) Range ±50 mT (also valid for ranges ±100 mT and ±200 mT), Gain = 1.0 (scales linearly with gain)

5.4 Magnetic Field Direction Definition

Figure 5-2 shows the definition of the magnetic field direction. By standard the south pole field defines the positive field values of the top die of the TLE4998S8(D).

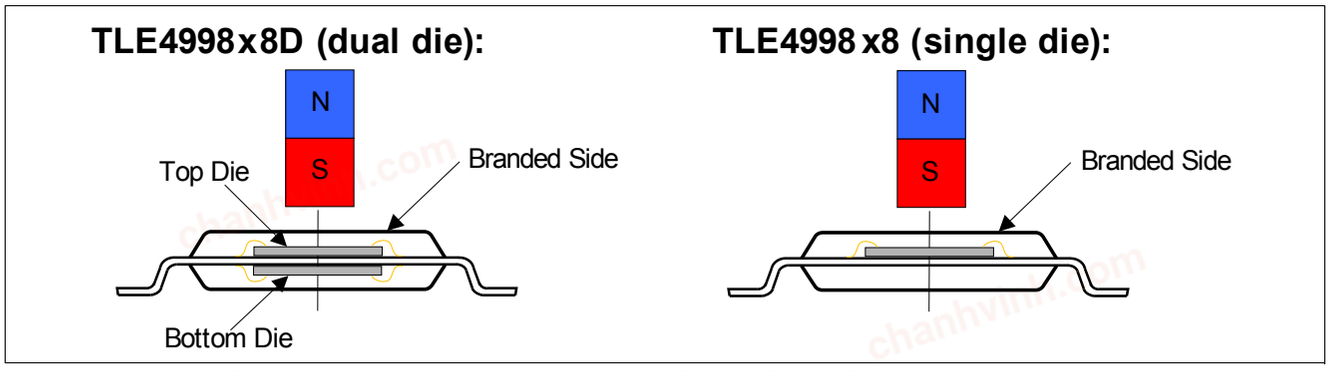


Figure 5-2 Definition of magnetic field direction of the PG-TDSO-8

For the TLE4998S8D, the bottom die measures the inverted field value of the top die. This leads to a default output characteristic as shown in Figure 5-3.

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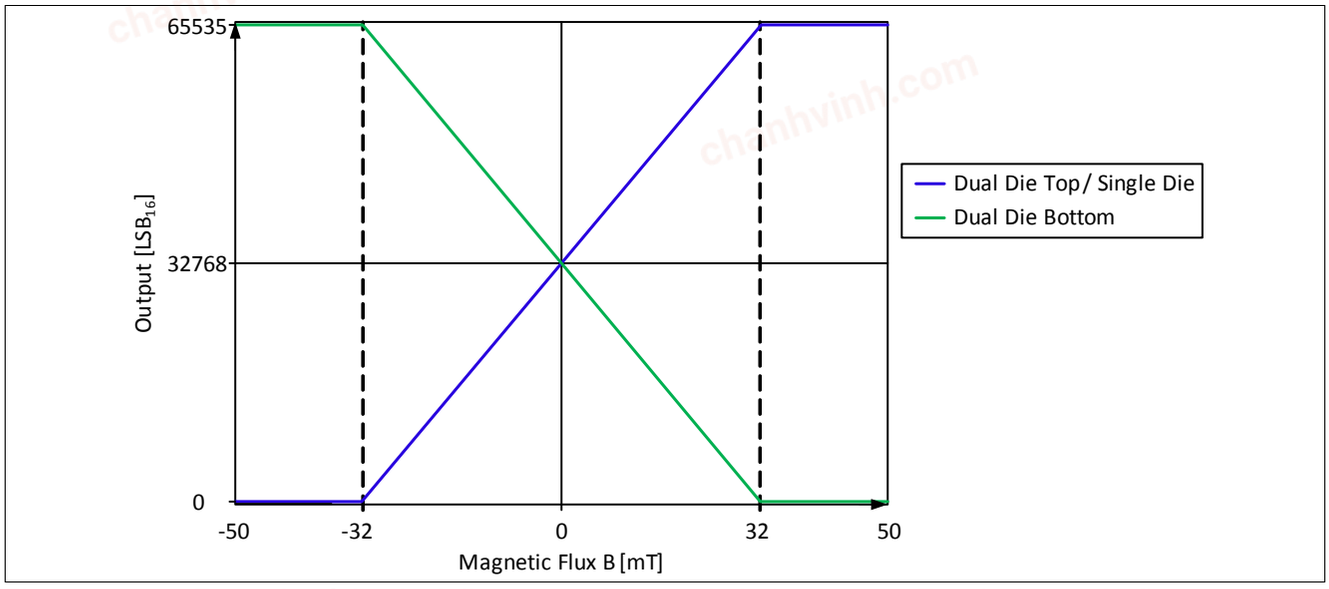


Figure 5-3 Example of the dual die output characteristic (range 50 mT, gain 1.0, typical)

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6 Application Circuit

Figure 6-1 shows the connection of two Linear Hall sensors to a micro controller.

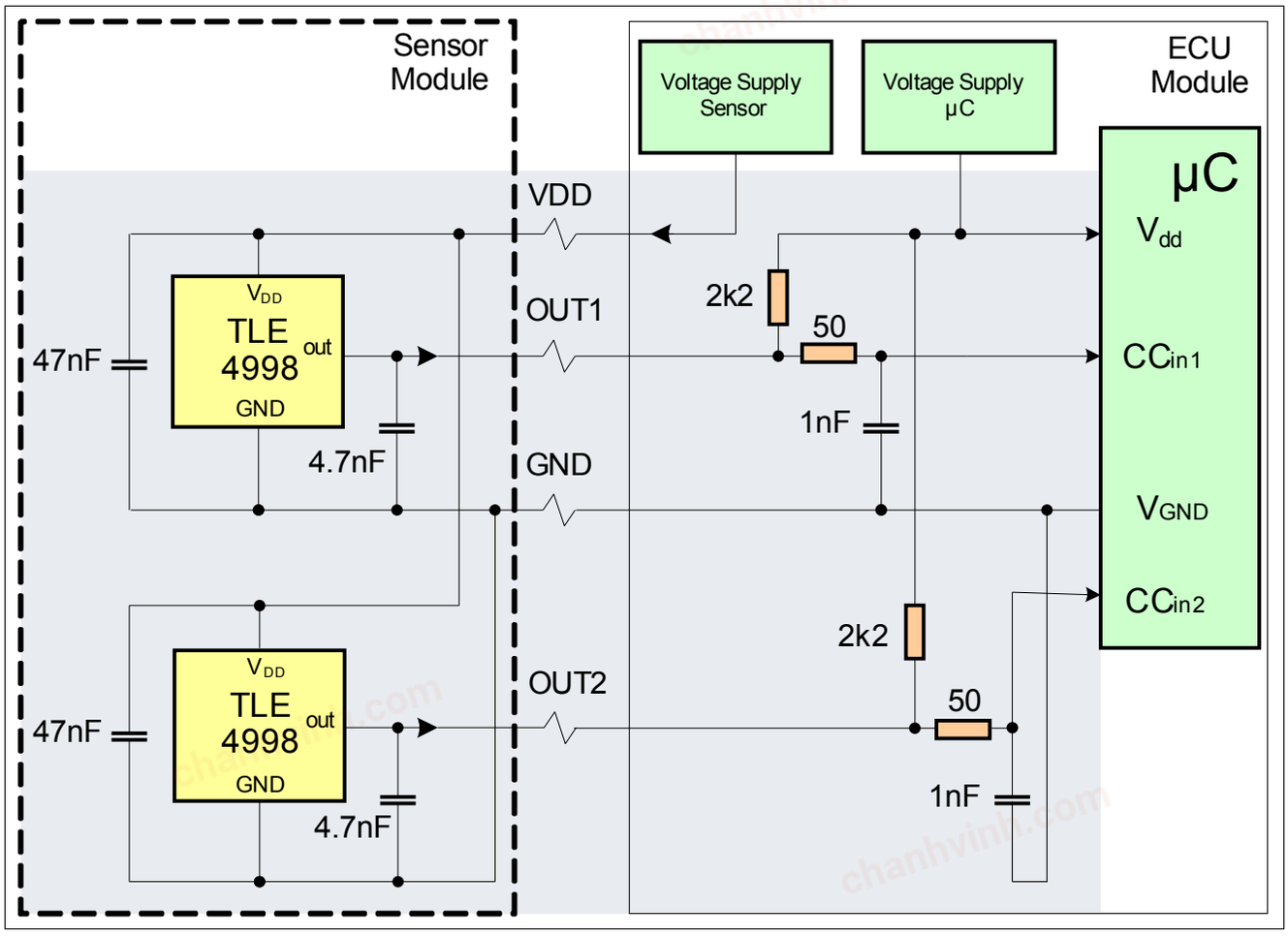


Figure 6-1 Application Circuit

Note: For calibration and programming, the interface has to be connected directly to the OUT pin.

The application circuit shown should be regarded as an example only. It will need to be adapted to meet the requirements of other specific applications. Further information is given in **Chapter 7**.

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7 SENT Output

The sensor supports a basic version of the Single Edge Nibble Transmission (SENT) protocol defined by SAE J2716. The main difference between the standard version and its implementation in the TLE4998 is the usage of an open drain instead of a push-pull output.

7.1 SENT Protocol

The single edge is defined by a 3 unit time (UT) low pulse on the output, followed by the high time defined in the protocol (nominal values, may vary by tolerance of internal RC oscillator and the programming, see **Chapter 7.2**). All values are multiples of a configurable unit time. A transfer consists of the following parts:

- A synchronization period of 56 UT (in parallel, a new sample is calculated)
- A status nibble of 12-27 UT
- Between 3 and 6 data nibbles of 12-27 UT each (number is programmable, see **Table 7-1**), representing the Hall value and temperature information.
- A CRC nibble of 12-27 UT

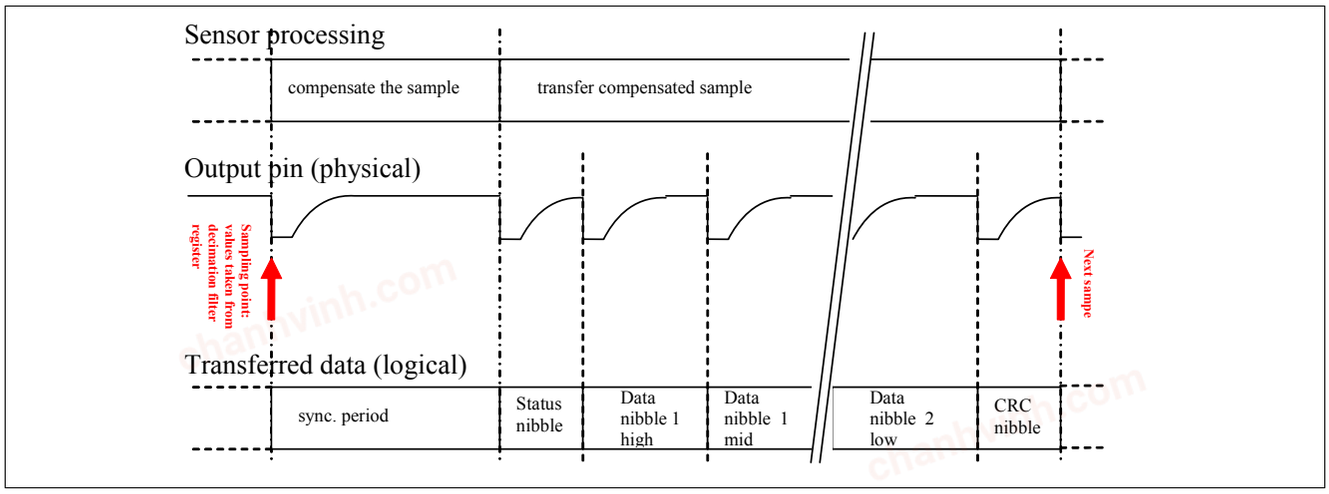


Figure 7-1 SENT Frame

The number of transmitted SENT nibbles is programmable to customize the amount of information sent by the sensor. The frame contains a 16 bit Hall value and an 8bit temperature value in the default configuration.

Table 7-1 Frame Selection

Frame Type	Parameter F	Data Nibbles
16 bit Hall, 8 bit temperature	0	6 nibbles
16 bit Hall	1	4 nibbles
12 bit Hall, 8 bit temperature	2	5 nibbles
12 bit Hall	3	3 nibbles

The CRC checksum includes the status nibble and the data nibbles and can be used to check the validity of the decoded data. It is calculated using a polynomial $x^4 + x^3 + x^2 + 1$ with a seed value of 0101. The calculation scheme of the CRC is described in detail in the **TLE4998 User's Manual**. The sensor's sampling time is at the beginning of the synchronization period. The temperature is coded as an 8 bit value. The value is transferred in unsigned integer format and corresponds to the range between -55 °C and +200 °C, so a transferred value of 55 corresponds to 0 °C. The temperature is additional information and although it is not calibrated, may be used for a plausibility check, for example. **Table 7-2** shows the mapping between junction temperature and the transmitted value in the SENT frame.

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Table 7-2 Mapping of Temperature Value

Junction Temperature	Typ. Decimal Value from Sensor	Note
- 55 °C	0	Theoretical lower limit[1)]
0 °C	55	–
25 °C	80	–
200 °C	255	Theoretical upper limit[1)]

1) Theoretical range of temperature values, exceeding absolute maximum ratings.

The status nibble as defined in the SAE standard has two free bits (the LSBs or first and second bit). These bits contain the selected magnetic range of the sensor and therefore allow the received data to be interpreted easily.

As no serial data is transferred with the IC, the remaining bits of the status nibble are not required. Instead, these bits are used to signal startup or overvoltage condition, as shown in **Figure 7-2**.

In case of startup- or supply overvoltage condition, the open-drain stage is disabled (high ohmic) and the corresponding status bits are set. After VDD has returned to the normal operating range, this status information will be transmitted within the first SENT transmission.

In case of an incorrectable EEPROM failure, the open-drain stage is disabled and is kept in “switched off” state permanently (high ohmic/ sensor defect).

7.2 Unit Time Setup

The basic SENT protocol unit time granularity is defined as 3 µs. Every timing is a multiple of this basic time unit. To achieve more flexibility, trimming of the unit time can be used to:

- Allow a calibration trim within a timing error of less than 20% clock error (as given in SAE standard)
- Allow a modification of the unit time for small speed adjustments

Table 7-3 Pre-divider Setting

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Unit time	t_{UNIT}	2.0	–	3.88	µs	Clk_{UNIT}=8 MHz[1)2)]

1) Prediv default is decimal = 8 for 3 µs nominal SENT unit time

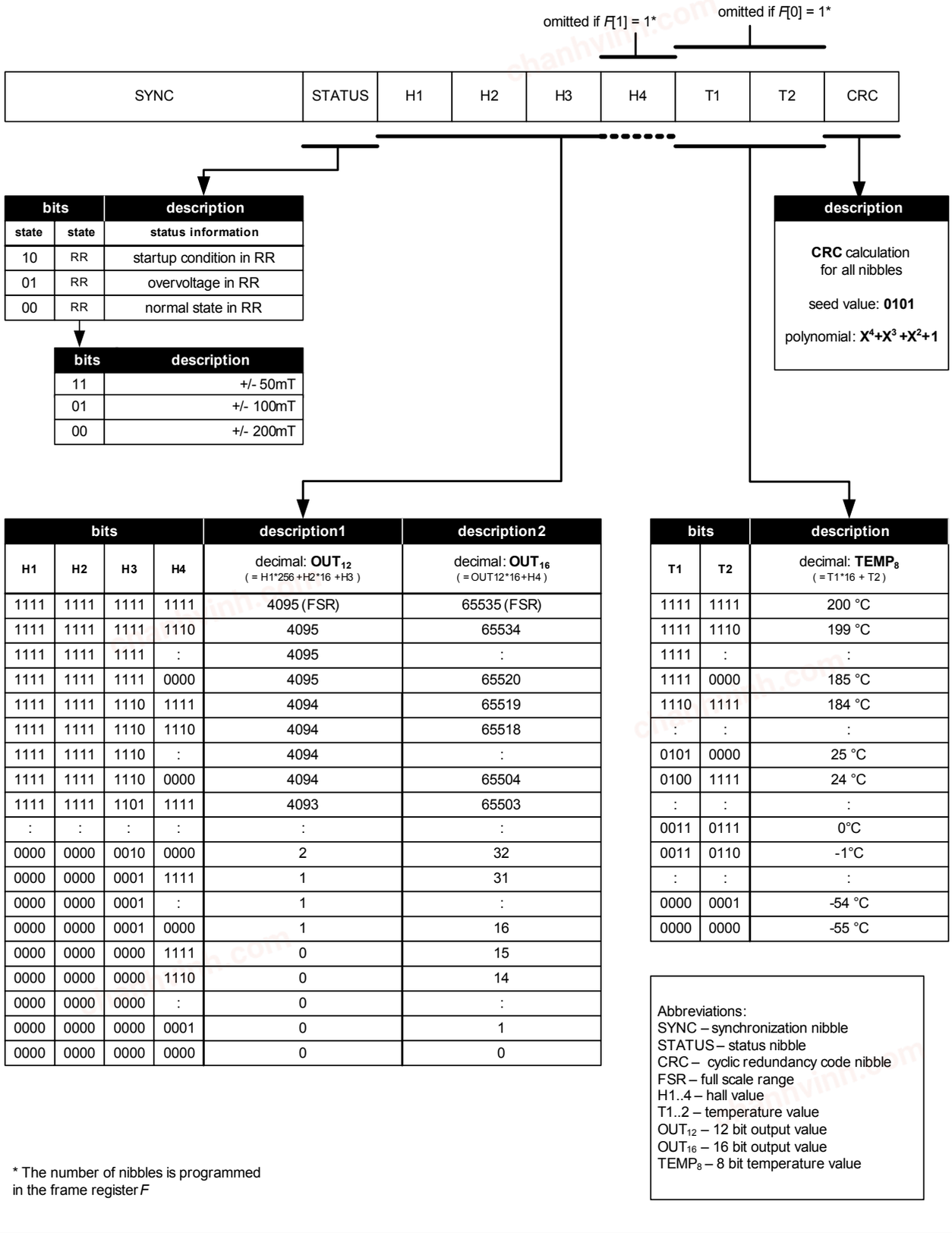
2) RC oscillator frequency variation ± 20%.

The nominal unit time is calculated by:

$$t_{UNIT} = (Prediv + 16) / Clk_{UNIT}$$

$$Clk_{UNIT} = 8\text{MHz} \pm 20\% \quad (7.1)$$

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bits		description
state	state	status information
10	RR	startup condition in RR
01	RR	overvoltage in RR
00	RR	normal state in RR

bits	description
11	+/- 50mT
01	+/- 100mT
00	+/- 200mT

description

CRC calculation for all nibbles

seed value: **0101**

polynomial: $X^4+X^3+X^2+1$

bits				description1	description2
H1	H2	H3	H4	decimal: OUT_{12} (= H1*256 +H2*16 +H3)	decimal: OUT_{16} (= OUT12*16+H4)
1111	1111	1111	1111	4095 (FSR)	65535 (FSR)
1111	1111	1111	1110	4095	65534
1111	1111	1111	:	4095	:
1111	1111	1111	0000	4095	65520
1111	1111	1110	1111	4094	65519
1111	1111	1110	1110	4094	65518
1111	1111	1110	:	4094	:
1111	1111	1110	0000	4094	65504
1111	1111	1101	1111	4093	65503
:	:	:	:	:	:
0000	0000	0010	0000	2	32
0000	0000	0001	1111	1	31
0000	0000	0001	:	1	:
0000	0000	0001	0000	1	16
0000	0000	0000	1111	0	15
0000	0000	0000	1110	0	14
0000	0000	0000	:	0	:
0000	0000	0000	0001	0	1
0000	0000	0000	0000	0	0

bits		description
T1	T2	decimal: $TEMP_8$ (= T1*16 + T2)
1111	1111	200 °C
1111	1110	199 °C
1111	:	:
1111	0000	185 °C
1110	1111	184 °C
:	:	:
0101	0000	25 °C
0100	1111	24 °C
:	:	:
0011	0111	0°C
0011	0110	-1°C
:	:	:
0000	0001	-54 °C
0000	0000	-55 °C

Abbreviations:
SYNC – synchronization nibble
STATUS – status nibble
CRC – cyclic redundancy code nibble
FSR – full scale range
H1..4 – hall value
T1..2 – temperature value
OUT_{12} – 12 bit output value
OUT_{16} – 16 bit output value
$TEMP_8$ – 8 bit temperature value

* The number of nibbles is programmed in the frame register *F*

Figure 7-2 Content of a SENT Data Frame (8 Nibbles)

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8 Configuration and Calibration Parameters

The TLE4998S8(D) has several configurable parameters which are stored in the EEPROM. These parameters affect the internal data processing and compensation and the output protocol. This chapter gives an overview of the parameters. A detailed description of all the parameters and the programming procedure is given in the **TLE4998 User's Manual**.

Table 8-1 TLE4998S8(D) Paramters

Parameter	Setting range	Note
Magnetic range	±50 mT ±100 mT ±200 mT	Magnetic input range of Hall ADC
Gain	-4.0...4.0	Gain value of +1.0 corresponds to typical 32 LSB_{12}/mT sensitivity in 100 mT range (64 LSB_{12}/mT in 50mT range)
Offset	-16384 LSB_{12} ... 16384 LSB_{12}	Quantization step: 1 LSB_{12}
Clamping low level	0 LSB_{16} ... 64512 LSB_{16}	Quantization step: 1024 LSB_{16} (see **Figure 8-1**)
Clamping high level	1023 LSB_{16} ... 65535 LSB_{16}	Quantization step: 1024 LSB_{16}
Bandwidth[1)]	80 Hz 240 Hz 440 Hz 640 Hz 860 Hz 1100 Hz 1390 Hz Off	Low-pass filter cut-off (-3 dB) frequency (see **Figure 8-2**)
1st order temperature coefficient TC_1	-1000 ppm/°C ... 2500 ppm/°C	2)
2nd order temperature coefficient TC_2	-4 ppm/°C^2 ... 4 ppm/°C^2	3)
SENT unit time[1)]		see **Chapter 7**
SENT protocol frames	16 bit Hall + 8 bit temperature 16 bit Hall 12 bit Hall + 8 bit temperature 12 bit Hall	see **Chapter 7**

1) Subject to oscillator variation ±20%.

2) Relative range to Infineon temperature pre-calibration, the maximum adjustable range is limited by the register-size and depends on specific pre-calibrated TL setting, full adjustable range: -2441 to +5355 ppm/°C.

3) Relative range to Infineon temperature pre-calibration, the maximum adjustable range is limited by the register-size and depends on specific pre-calibrated TQ setting, full adjustable range: -15 to +15 ppm/°C^2.

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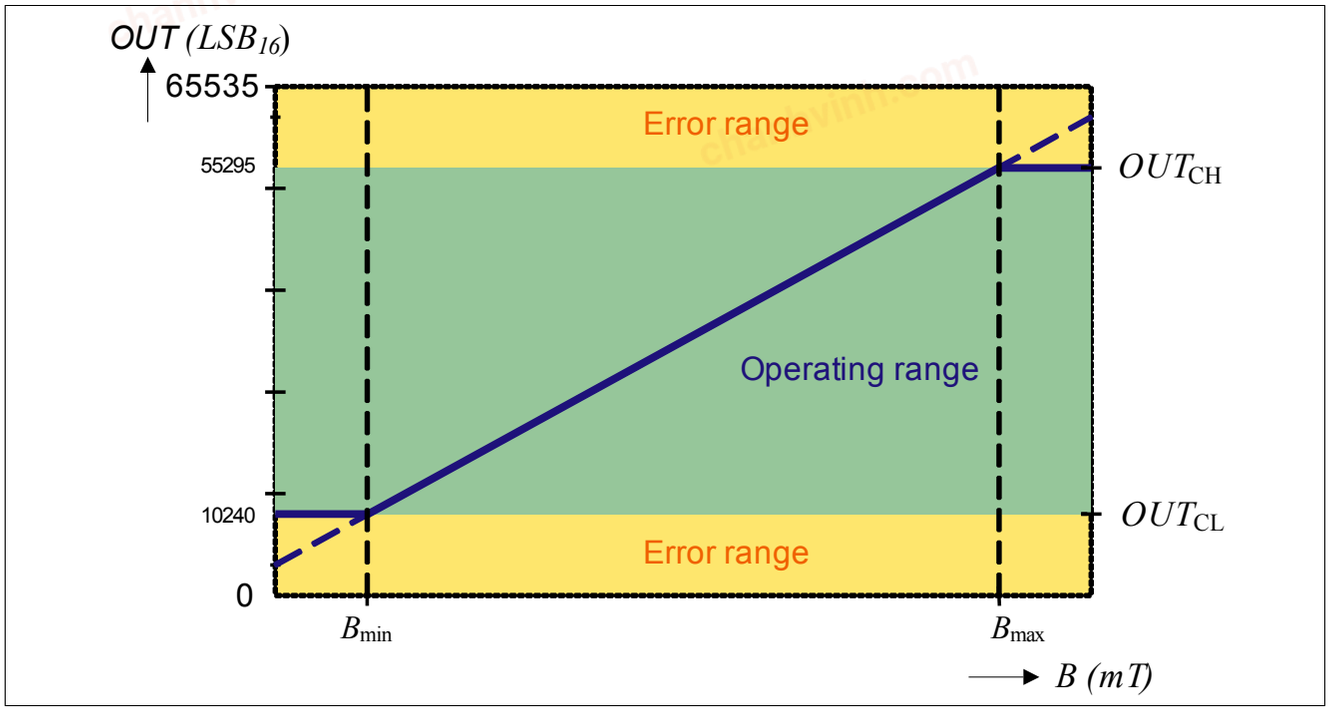


Figure 8-1 Clamping Example

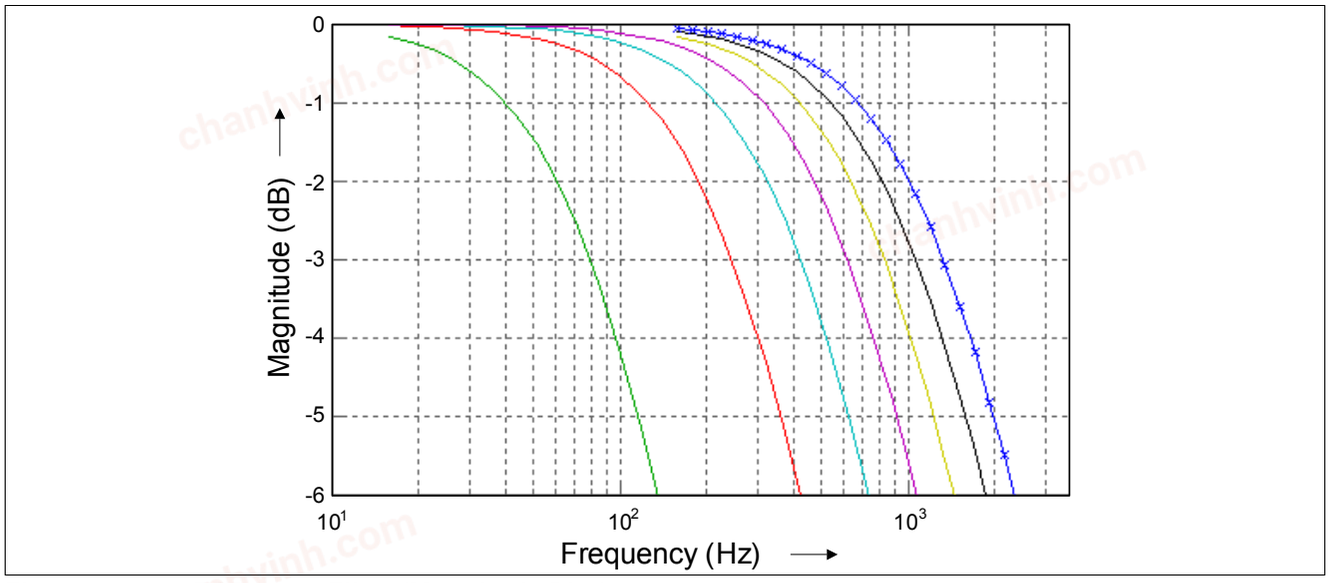


Figure 8-2 DSP Input Filter (Magnitude Plot)

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9 Error Detection

Different error cases can be detected by the On-Board Diagnostics (OBD) and reported to the micro controller in the status nibble (see **Chapter 7**).

9.1 Voltages Outside the Operating Range

- Inside the ratings specified in **Table 3-1 “Absolute Maximum Ratings” on Page 8**
- Outside the range specified in **Table 4-1 “Operating Range” on Page 9**

The output signals an error condition if V_{DD} crosses the overvoltage threshold level.

Table 9-1 Overvoltage

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Overvoltage threshold	V_{DDov}	16.65	17.5	18.35	V	

9.2 EEPROM Error Correction

The parity method is able to correct a single bit in the EEPROM line. One other single bit error in another EEPROM line can also be detected, but not corrected. In case there is an incorrectable EEPROM failure, the open drain stage is disabled and permanently kept in off state (high ohmic/sensor defect).

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10 PG-TDSO-8 Package Outlines

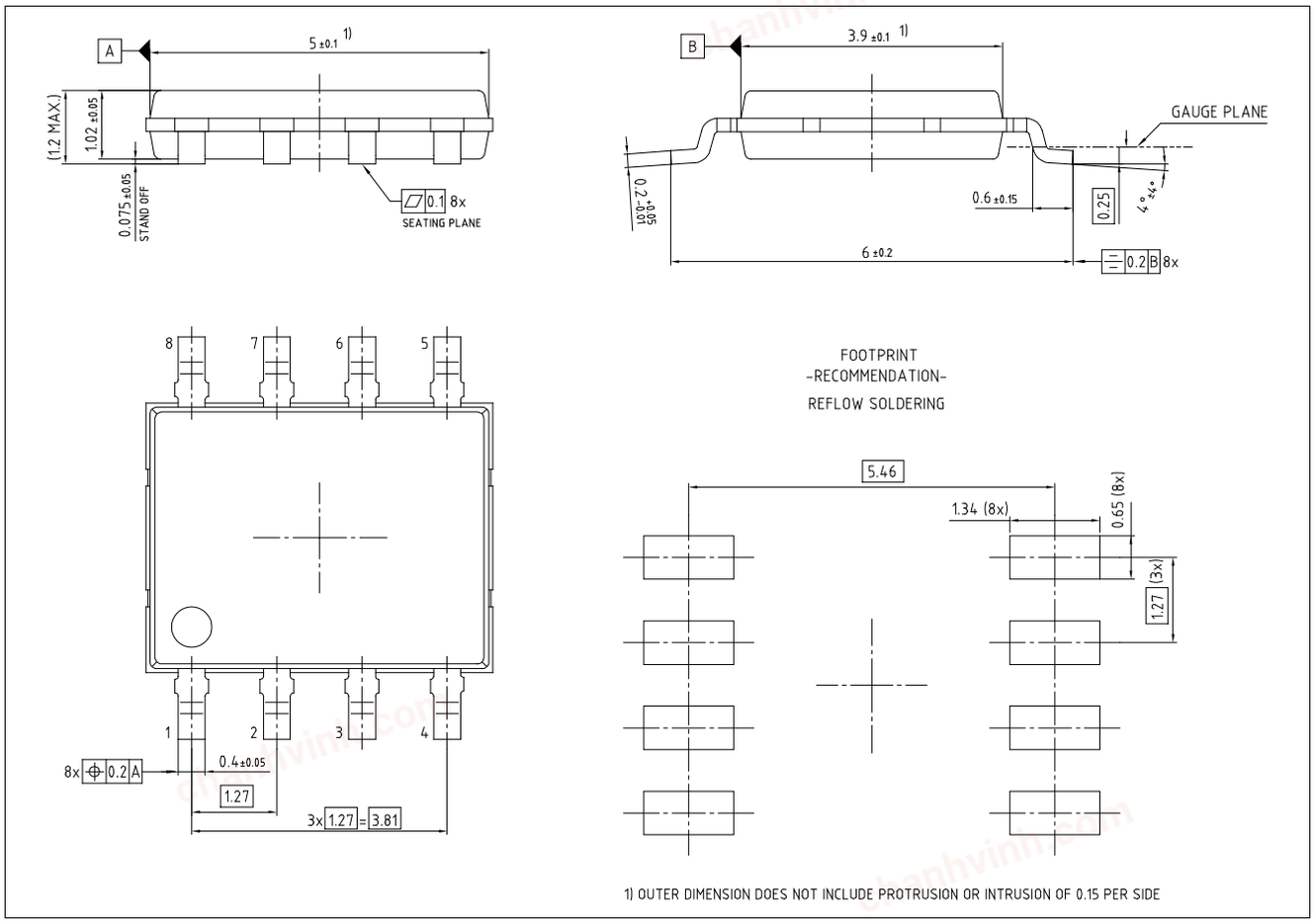


Figure 10-1 PG-TDSO-8 (PG-TDSO-Plastic Green Thin Dual Small Outline), Package Dimensions

10.1 Distance Chip to package

Figure 10-2 shows the distance of the chip surface to the PG-TDSO-8 surface.

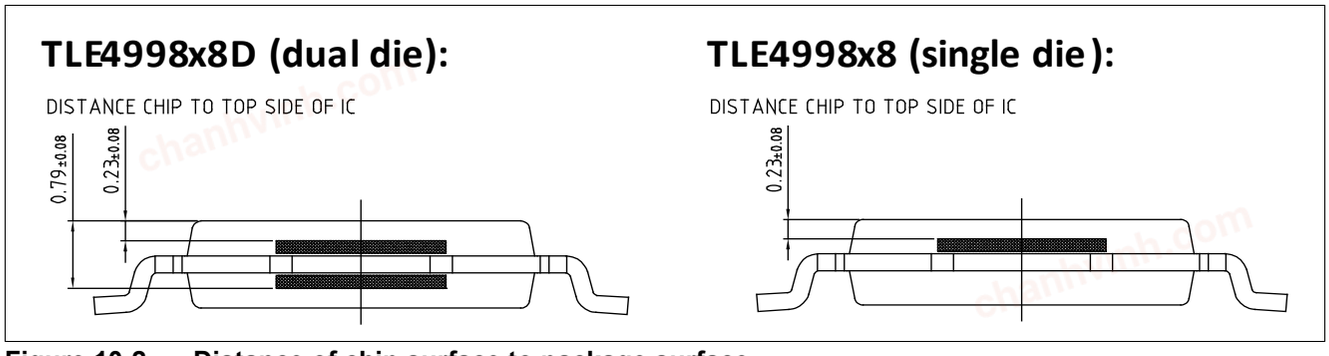


Figure 10-2 Distance of chip surface to package surface

10.2 Moisture Sensitivity Level (MSL)

The PG-TDSO-8 fulfills the MSL level 3 according to IPC/JEDEC J-STD-033B.1.

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10.3 PG-TDSO-8 Package Marking

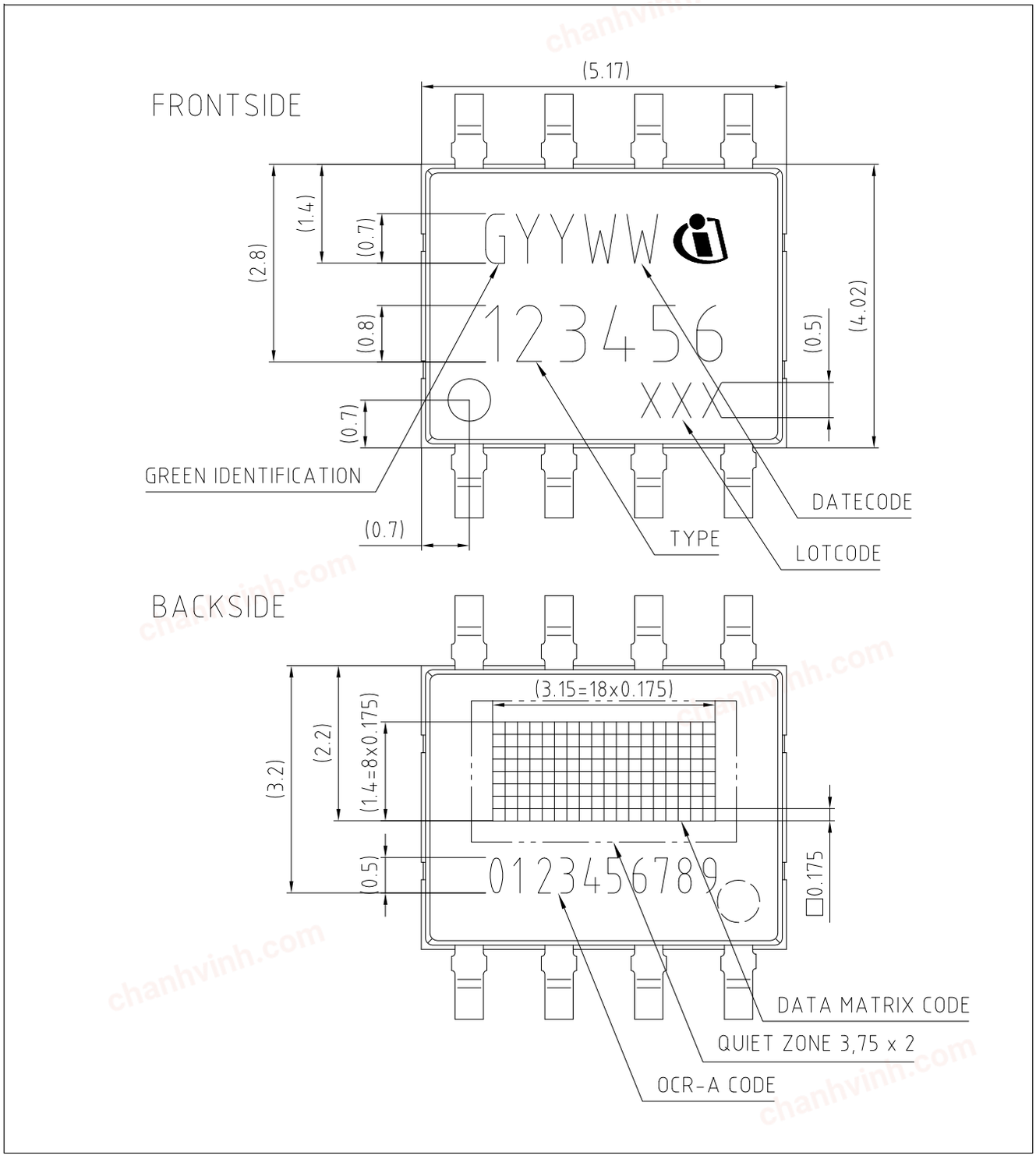


Figure 10-3 PG-TDSO-8 (PG-TDSO-Plastic Green Thin Dual Small Outline), Package Marking

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Revision History	
Page or Item	**Subjects (major changes since previous revision)**
Revision 1.1, 2017-01	
Page 10	Added Note / Test Condition to parameter **Output noise (rms)**
Page 12	Added Note / Test Condition to parameter **Output noise (rms)**
Page 14	Corrected typo in **Chapter 7.1**, 9 µs low pulse corrected to 3 unit time (UT)

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