

# KMZ41

## Magnetic field sensor

Rev. 05 — 27 November 2006

Product data sheet

## 1. Product profile

### 1.1 General description

The KMZ41 is a sensitive magnetic field sensor, employing the magneto-resistive effect of thin film permalloy. The sensor contains two galvanic separated Wheatstone bridges, which enclose an angle of 45 degrees.

A rotating magnetic field strength  $> 40$  kA/m (recommended field strength  $> 100$  kA/m) in the surface parallel to the chip (x-y plane) will deliver two independent sinusoidal output signals, one following a  $\cos(2\alpha)$  and the second following a  $\sin(2\alpha)$  function.

The sensor can be operated at any frequency between DC and 1 MHz.

Application notes *AN00023* (contactless angle measurement using KMZ41 and UZZ9000) and *AN00004* (contactless angle measurement using KMZ41 and UZZ9001) are available.

### 1.2 Features

- Accurate and reliable angle measurement
- Mechanical robustness, contactless principle
- Wear-free operation
- Accuracy independent on mechanical tolerances
- Extended temperature range

### 1.3 Quick reference data

**Table 1. Quick reference data**

$T_{amb} = 25^\circ\text{C}$  and  $H_{ext} = 100$  kA/m,  $V_{CC} = 5$  V unless otherwise specified.

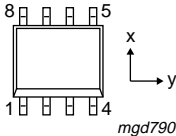
| Symbol       | Parameter         | Conditions                                          | Min        | Typ | Max | Unit       |
|--------------|-------------------|-----------------------------------------------------|------------|-----|-----|------------|
| $V_{CC}$     | supply voltage    |                                                     | [1] -      | 5   | 9   | V          |
| $V_{peak}$   | peak voltage      | see <a href="#">Figure 2</a>                        | [1] 70     | 78  | 86  | mV         |
| $V_{offset}$ | offset voltage    | per supply voltage;<br>see <a href="#">Figure 2</a> | [1] -2     | -   | +2  | mV/V       |
| $R_{bridge}$ | bridge resistance |                                                     | [1][2] 2.0 | 2.5 | 3.0 | k $\Omega$ |

[1] Applicable for bridge 1 and bridge 2.

[2] Bridge resistance between pin 4 to pin 8, pin 3 to pin 7, pin 5 to pin 1 and pin 6 to pin 2.

## 2. Pinning information

Table 2. Pinning

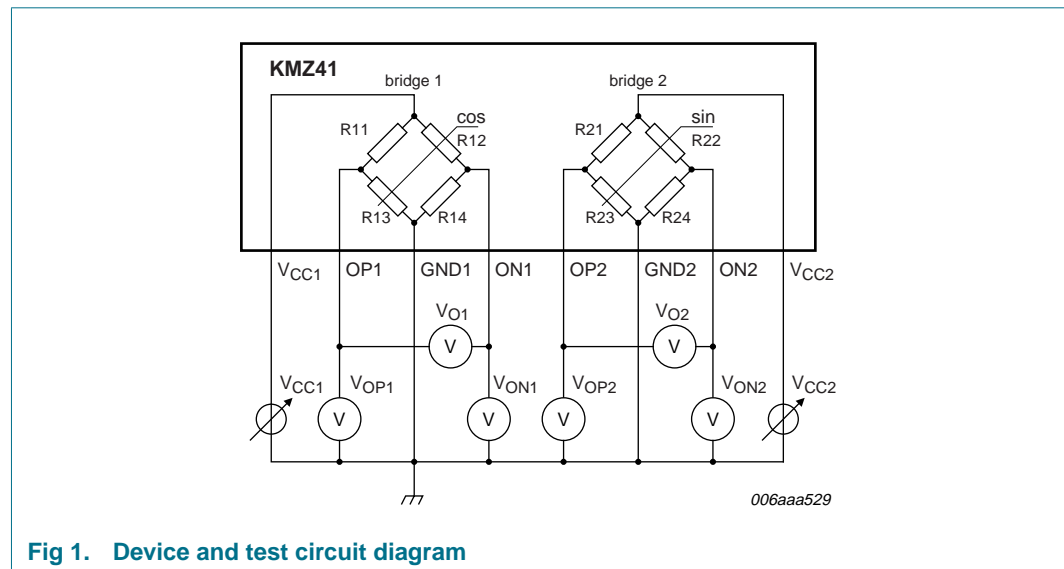
| Pin | Symbol           | Description             | Simplified outline                                                                                |
|-----|------------------|-------------------------|---------------------------------------------------------------------------------------------------|
| 1   | ON1              | output voltage bridge 1 |  <p>mgd790</p> |
| 2   | ON2              | output voltage bridge 2 |                                                                                                   |
| 3   | V <sub>CC2</sub> | supply voltage bridge 2 |                                                                                                   |
| 4   | V <sub>CC1</sub> | supply voltage bridge 1 |                                                                                                   |
| 5   | OP1              | output voltage bridge 1 |                                                                                                   |
| 6   | OP2              | output voltage bridge 2 |                                                                                                   |
| 7   | GND2             | supply voltage bridge 2 |                                                                                                   |
| 8   | GND1             | supply voltage bridge 1 |                                                                                                   |

## 3. Ordering information

Table 3. Ordering information

| Type number | Package |                                                           |         |
|-------------|---------|-----------------------------------------------------------|---------|
|             | Name    | Description                                               | Version |
| KMZ41       | SO8     | plastic small outline package; 8 leads; body width 3.9 mm | SOT96-1 |

## 4. Circuit diagram



## 5. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol           | Parameter                        | Conditions | Min | Max  | Unit |
|------------------|----------------------------------|------------|-----|------|------|
| V <sub>CC</sub>  | supply voltage                   | [1]        | -   | 9    | V    |
| H <sub>ext</sub> | external magnetic field strength |            | 40  | -    | kA/m |
| T <sub>amb</sub> | ambient temperature              |            | -40 | +150 | °C   |
| T <sub>stg</sub> | storage temperature              |            | -65 | +150 | °C   |

[1] Applicable for bridge 1 and bridge 2.

## 6. Thermal characteristics

**Table 5. Thermal characteristics**

| Symbol               | Parameter                                   | Conditions | Typ | Unit |
|----------------------|---------------------------------------------|------------|-----|------|
| R <sub>th(j-a)</sub> | thermal resistance from junction to ambient |            | 155 | K/W  |

## 7. Characteristics

**Table 6. Characteristics**

$T_{amb} = 25\text{ °C}$  and  $H_{ext} = 100\text{ kA/m}$ ,  $V_{CC} = 5\text{ V}$  unless otherwise specified.

| Symbol         | Parameter                                        | Conditions                                                                       | Min          | Typ   | Max    | Unit           |
|----------------|--------------------------------------------------|----------------------------------------------------------------------------------|--------------|-------|--------|----------------|
| $V_{CC}$       | supply voltage                                   |                                                                                  | [1] -        | 5     | 9      | V              |
| $V_{peak}$     | peak voltage                                     | see Figure 2                                                                     | [1] 70       | 78    | 86     | mV             |
| $TCV_{peak}$   | temperature coefficient of peak voltage          | $T_{amb} = -40\text{ °C}$ to $+150\text{ °C}$                                    | [1][2] -0.38 | -0.41 | -0.44  | %/K            |
| $R_{bridge}$   | bridge resistance                                |                                                                                  | [1][3] 2.0   | 2.5   | 3.0    | k $\Omega$     |
| $TCR_{bridge}$ | temperature coefficient of bridge resistance     | $T_{amb} = -40\text{ °C}$ to $+150\text{ °C}$                                    | [1][4] 0.31  | 0.33  | 0.35   | %/K            |
| $V_{offset}$   | offset voltage                                   | per supply voltage; see Figure 2                                                 | [1] -2       | -     | +2     | mV/V           |
| $TCV_{offset}$ | temperature coefficient of offset voltage        | per supply voltage; $T_{amb} = -40\text{ °C}$ to $+150\text{ °C}$ ; see Figure 2 | [1][5] -2    | -     | +2     | ( $\mu$ V/V)/K |
| FH             | hysteresis of output voltage                     | see Figure 3                                                                     | [1][6] 0     | 0.01  | 0.04   | %FS            |
| k              | amplitude synchronism                            |                                                                                  | [7] 99       | 100   | 101    | %              |
| Tck            | temperature coefficient of amplitude synchronism | $T_{amb} = -40\text{ °C}$ to $+150\text{ °C}$                                    | [8] -0.005   | 0     | +0.005 | %/K            |
| $\Delta\alpha$ | angular inaccuracy                               |                                                                                  | [9] 0        | 0.1   | 0.25   | deg            |

[1] Applicable for bridge 1 and bridge 2.

$$[2] \quad TCV_{peak} = 100 \times \frac{V_{peak}(at\ 150\text{ °C}) - V_{peak}(at\ -40\text{ °C})}{V_{peak}(at\ 25\text{ °C}) \times (150\text{ °C} - (-40\text{ °C}))}$$

[3] Bridge resistance between pin 4 to pin 8, pin 3 to pin 7, pin 5 to pin 1 and pin 6 to pin 2.

$$[4] \quad TCR_{bridge} = 100 \times \frac{R_{bridge}(at\ 150\text{ °C}) - R_{bridge}(at\ -40\text{ °C})}{R_{bridge}(at\ 25\text{ °C}) \times (150\text{ °C} - (-40\text{ °C}))}$$

$$[5] \quad TCV_{offset} = \frac{V_{offset}(at\ 150\text{ °C}) - V_{offset}(at\ -40\text{ °C})}{150\text{ °C} - (-40\text{ °C})}$$

$$[6] \quad FH_1 = 100 \times \left| \frac{V_{O1}(67.5^\circ)135^\circ \rightarrow 45^\circ - V_{O1}(67.5^\circ)45^\circ \rightarrow 135^\circ}{2 \times V_{peak1}} \right|$$

$$FH_2 = 100 \times \left| \frac{V_{O2}(22.5^\circ)90^\circ \rightarrow 0^\circ - V_{O2}(22.5^\circ)0^\circ \rightarrow 90^\circ}{2 \times V_{peak2}} \right|$$

$$[7] \quad k = 100 \times \frac{V_{peak1}}{V_{peak2}}$$

$$[8] \quad Tck = 100 \times \frac{k(at\ 150\text{ °C}) - k(at\ -40\text{ °C})}{k(at\ 25\text{ °C}) \times (150\text{ °C} - (-40\text{ °C}))}$$

[9]  $\Delta\alpha = |\alpha_{real} - \alpha_{meas}|$ ;  $V_{offset} = 0\text{ V}$ ; inaccuracy of angular measurement due to deviations from ideal sinusoidal characteristics, calculated from the third and fifth harmonics of the spectrum of  $V_O$ .

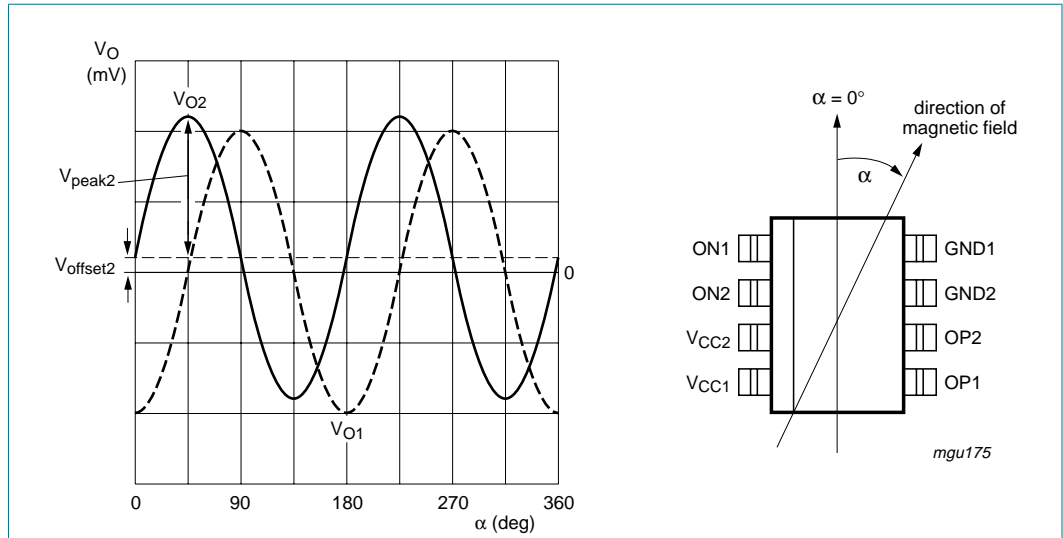


Fig 2. Output signals related to the direction of the magnetic field

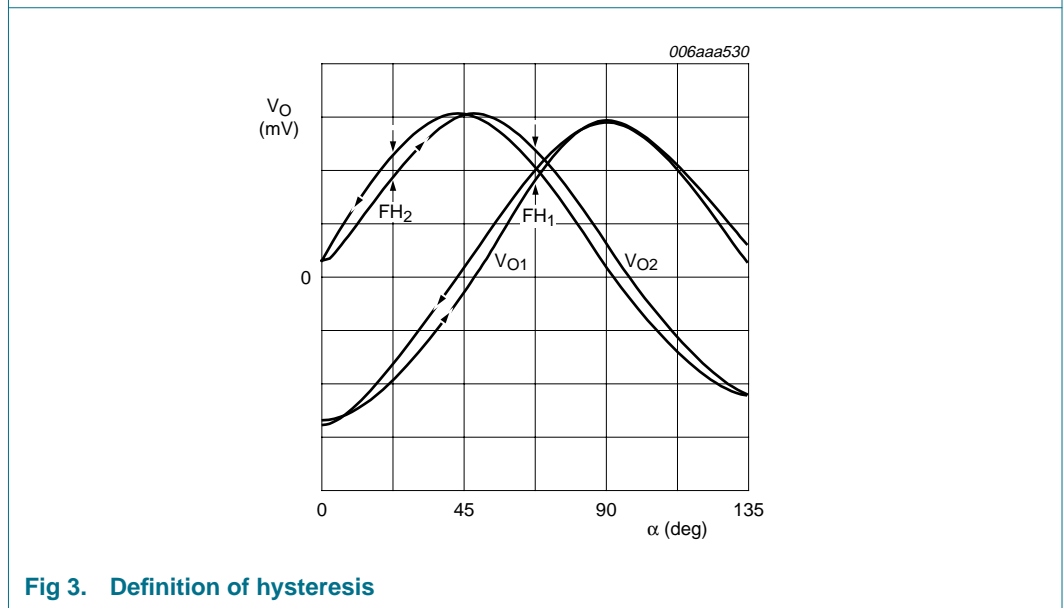


Fig 3. Definition of hysteresis

8. Package outline

SO8: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1

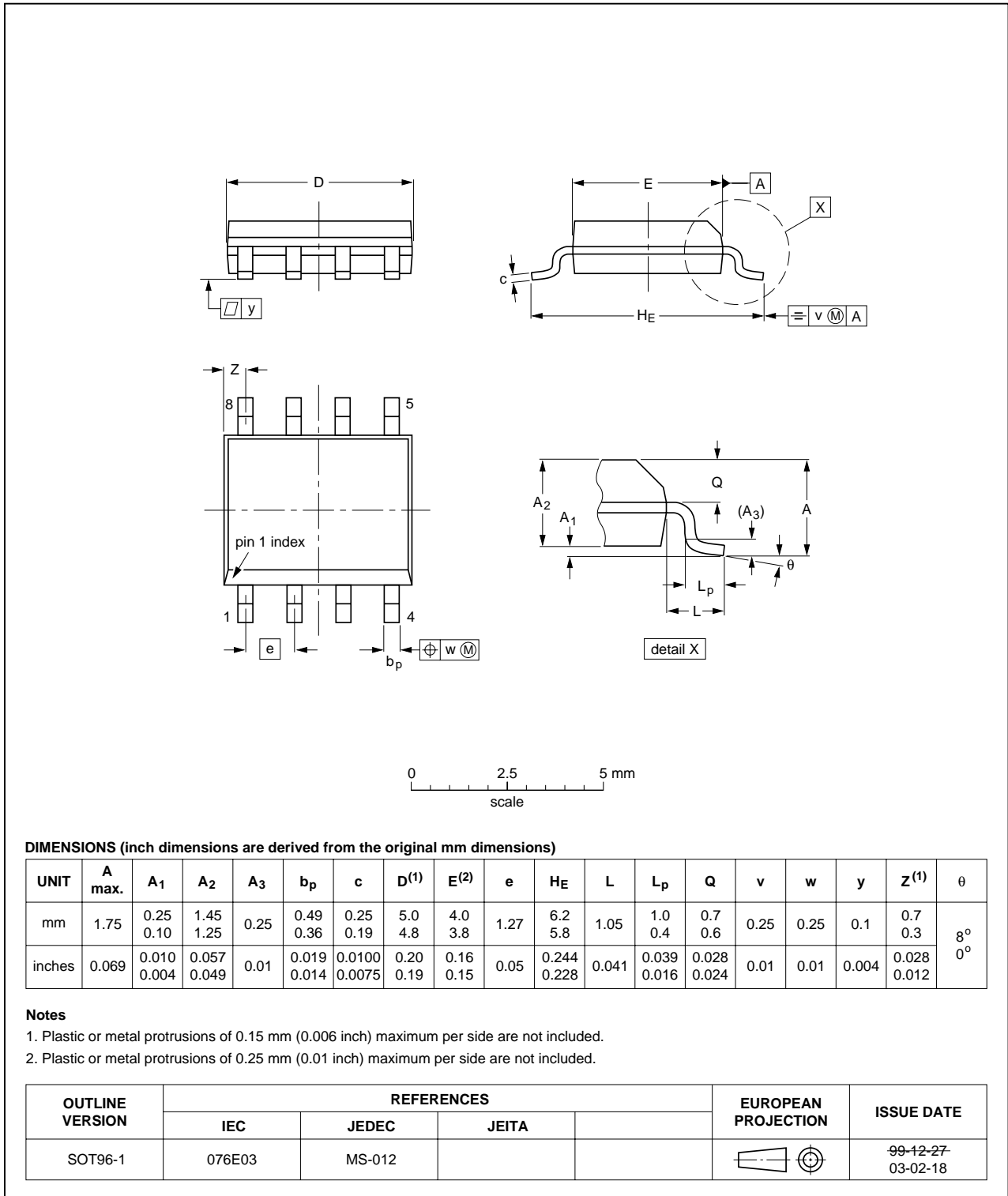


Fig 4. Package outline SOT96-1 (SO8/MS-012)

## 9. Packing information

**Table 7. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

| Type number | Package | Description                     | Packing quantity |
|-------------|---------|---------------------------------|------------------|
|             |         |                                 | <b>2500</b>      |
| KMZ41       | SOT96-1 | 8 mm pitch, 12 mm tape and reel | -118             |

[1] 12NC ordering code: 9340 372 10118. For further information and the availability of packing methods, see [Section 12](#).

## 10. Revision history

**Table 8. Revision history**

| Document ID    | Release date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Data sheet status         | Change notice | Supersedes |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------|------------|
| KMZ41_5        | 20061127                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Product data sheet        | -             | KMZ41_4    |
| Modifications: | <ul style="list-style-type: none"> <li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• <a href="#">Section 1.1 “General description”</a>: amended</li> <li>• <a href="#">Section 1.2 “Features”</a>: added</li> <li>• <a href="#">Table 1 “Quick reference data”</a>: <math>V_{\text{peak}}</math> peak voltage added</li> <li>• <a href="#">Table 1</a>: <math>R_{\text{bridge}}</math> bridge resistance <a href="#">Table note 2</a> added</li> <li>• <a href="#">Table 2 “Pinning”</a>: amended</li> <li>• <a href="#">Section 3 “Ordering information”</a>: added</li> <li>• <a href="#">Figure 1 “Device and test circuit diagram”</a>: amended</li> <li>• <a href="#">Table 4 “Limiting values”</a>: <math>H_{\text{ext}}</math> external magnetic field strength added</li> <li>• <a href="#">Table 4</a>: <math>T_{\text{bridge}}</math> bridge operating temperature redefined to <math>T_{\text{amb}}</math> ambient temperature</li> <li>• <a href="#">Table 6 “Characteristics”</a>: <math>H_{\text{rotation}}</math> redefined to <math>H_{\text{ext}}</math> external magnetic field strength</li> <li>• <a href="#">Figure 3 “Definition of hysteresis”</a>: added</li> <li>• <a href="#">Section 9 “Packing information”</a>: added</li> </ul> |                           |               |            |
| KMZ41_4        | 20000418                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Preliminary specification | -             | KMZ41_3    |



## 11. Legal information

### 11.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition                                                                            |
|-----------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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