# Glass Tube Transponder

## Description

The e5530GT is part of a closed coupled identification system. It receives power from an RF transmitter (base station, reader) which is coupled inductively to the IDIC.

Receiving RF, the **ID**entification **IC** (IDIC®) is powered up and responds with a data stream by damping the incoming RF via an internal load. This damping-in-turn can be detected by the reader. The identifying data are stored in a Laser–ROM on the e5530, which is factory-programmed with a unique code.

The ID code and other features like bitrate and modulation method are programmed according to the customer's request.

## Features

- Low power, low voltage CMOS IDIC®
- LC antenna tuned to 125 kHz ± 3%
- Needs only 6 A/m for correct operation
- Encapsulated in a tiny glass tube dimensions: 12.0 × ∅ 2.1 mm
- Contactless power supply
- Contactless read data transmission
- Up to 128 bits of factory-programmed ID code
- Several transmission options:
  Code length: 32, 64, 96, 128 bits
  Bitrate: RF/8, RF/16, RF/32, RF/40, RF/50 RF/64, RF/80, RF/100, RF/128
  Modulation: FSK, PSK, Manchester, Biphase

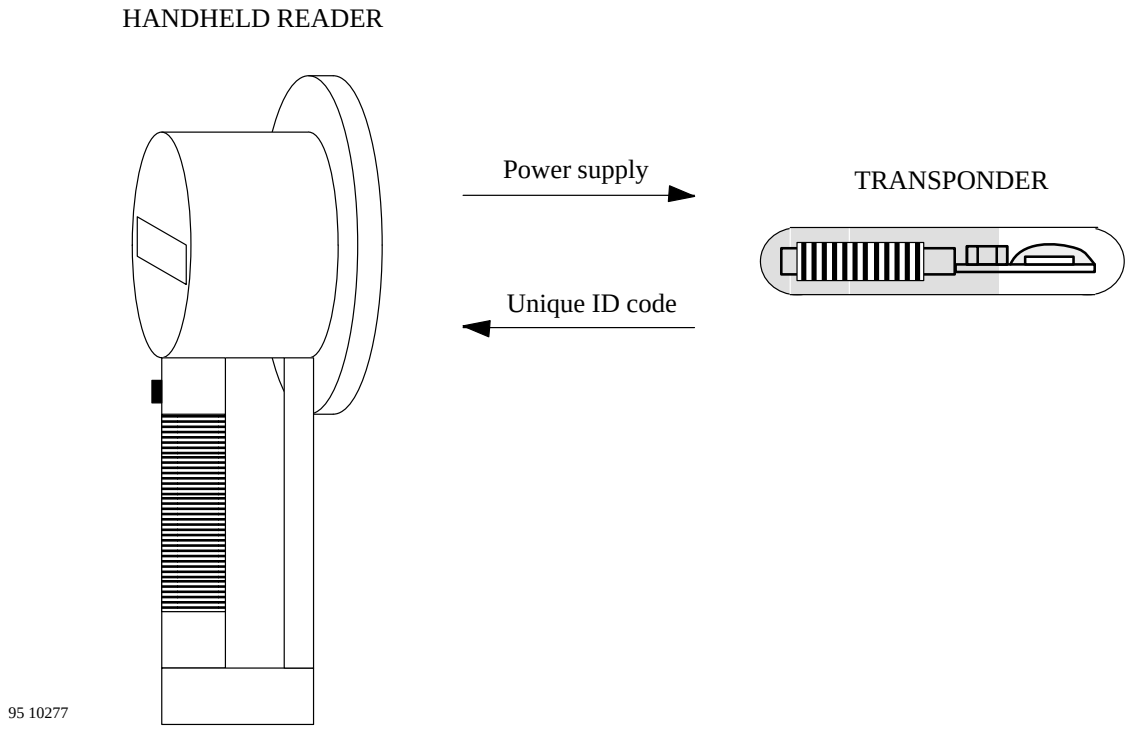



Figure 1. A transponder system example using the e5530GT

# Functional Description

## Supply

The e5530GT consists of a tuned coil and the e5530 IDIC®. This tuned coil has to be inductively coupled to the coil of the base station.

The base station coil generates a magnetic RF field, which induces a current at the transponder coil. At resonance frequency, several volts are available at the coil terminals. The IDIC® is powered by this energy.

Since the e5530 needs only some micro watt for correct operation, the transponder can operate in very weak magnetic fields.

## Read

After power-up, the e5530 starts transmission of the ID code in the laser ROM.

Data transmission occurs by damping the incoming RF by an internal load. This load changing can be detected by the base station.

There are four modulation methods available.

**FSK Modulation**

A data ‘1’ and a data ‘0’ are represented as two different frequencies of damping. The frequency of a ‘1’ is RF/10 and a ‘0’ divides RF/8.

**PSK Modulation**

The coil is damped with a carrier frequency of RF/2. The data ‘1’ causes a 180° phase shift on the carrier, while a ‘0’ does no phase shift.

**Manchester Modulation**

Logical ‘1’ makes a falling edge during a bit time (i.e., switch damping on). The ‘0’ makes a rising edge (i.e., switch damping off).

**Biphase Modulation**

The coil is damped with a carrier frequency which is similar to the bitclock at a ‘1’. A ‘0’ doubles the carrier period.

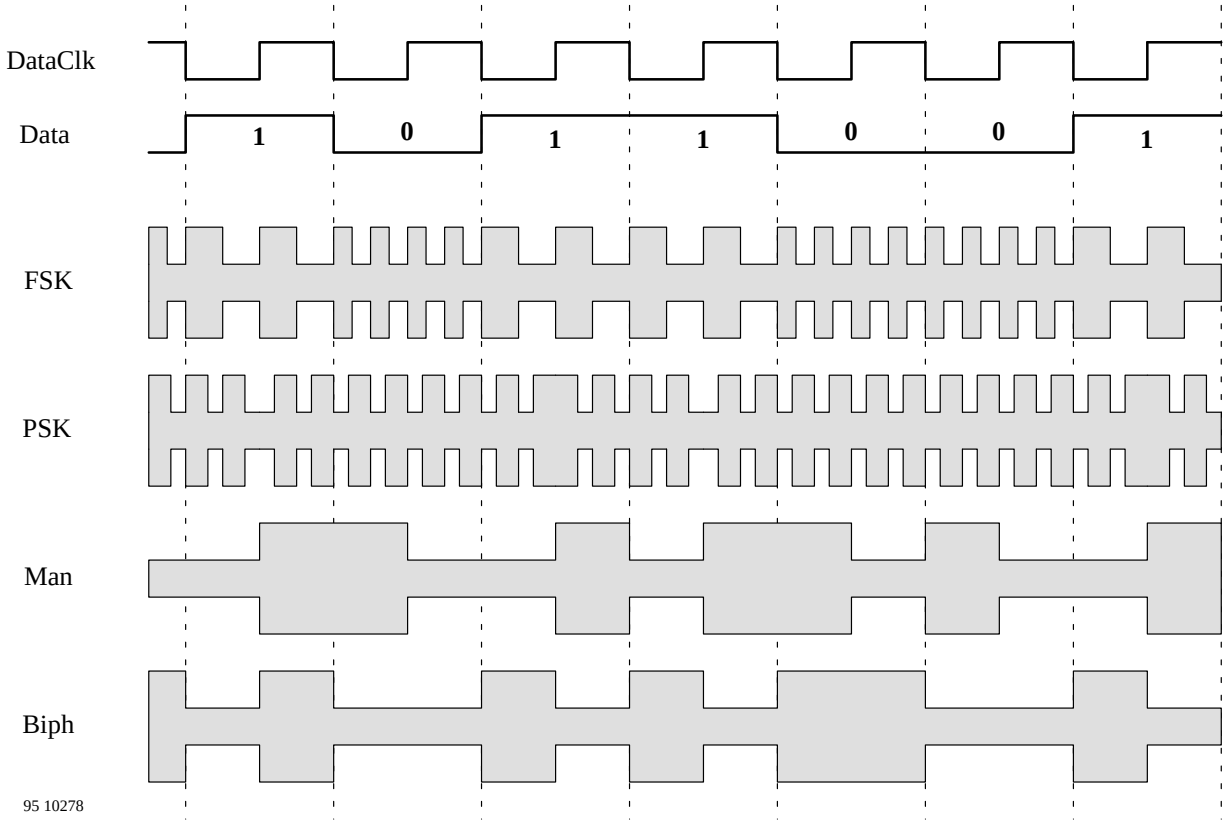



Figure 2. Types of modulation (shown as transponder coil voltage)

## Absolute Maximum Ratings

Stresses above those listed below may cause permanent damage to the device.

| Parameters | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Operating ambient temperature | $T_{op}$ | –40 | | 85 | °C |
| Storage temperature | $T_{st}$ | –40 | | 100 | °C |
| Assembly temperature < 5 min | $T_{assy}$ | | 170 | | °C |
| Assembly pressure isostatic | $p_{assy}$ | | 50 | | °C |

## Electrical and Magnetic Characteristics

$T_{amb}$ = 25°C unless otherwise specified

| Parameters | Test Conditions / Pins | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Resonance frequency | | $f_{res}$ | 121.25 | 125 | 128.75 | kHz |
| LC quality | $V_{coil}$ < 0.5 V | Q | 13 | 17 | 21 | – |
| Resonance frequency deviation | T = –40 to +85°C | $Df_{res}$ | –1 | | +1 | % |
| Coil inductance | L and C are ± 5% (sorted to met $f_{res+}$) | L | 3.99 | 4.20 | 4.41 | mH |
| Resonance capacitor | | C | 370 | 390 | 410 | pF |
| Minimum magnetic field strength | @ $f_{res}$ | $H_{opmin}$ | | 6 | | A/m |

## Mechanical Characterristics

| Parameters | Description | Comment | Value | Unit |
|---|---|---|---|---|
| Shock | 6 shocks per axe, all 3 axes | IEC 68–2–27 | 1500 | g |
| Vibration | 100 to 20000 Hz, 6 h/ axe, 3 axes | IEC 68 2–27 Fc | 5 | g |
| Mechanical strength | Horizontal and vertical | | 5 | N |

# Order Information

## ID Code Selection

The customer can choose any ID code suitable to his application. To avoid code duplication, TEMIC will define a fixed header – i.e, the first 8 bits of the code – for each customer. For programming the code into the laser ROM, one of the following has to be supplied:

- ID code on floppy disk or per email (i.e., the customer is generating the codes). The format is:
  - ASCII format
  - Each line contain one ID code in hex notation
  - First 8 code bits must be the TEMIC-defined header
  - Each line must start with a unique sequence number (please refer to our "e5530 Code Format Application Note" for further details)
- ID code algorithm which is implemented in our code management software (i.e., we are generating the codes as necessary)

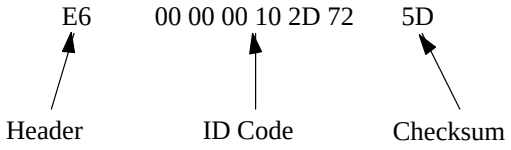



Figure 3. Example for a 64 bit code

## Options

Further, the customer has to select the following operation options:

- Bitrate, which is defined as field clocks per bit (e.g., RF/40 = 125 kHz/40 = 3.125 kBit/s)
- Modulation (see page 2)
- Code length: 32, 64, 96 and 128 bits

## Order Code

The full order code for the e5530GT transponder is **e5530H–xxx GT**, where xxx is the header number defined by TEMIC.

# Application

## Samples

TEMIC supplies e5530GT samples, which are set to Manchester modulation at RF/40 with a 64 bit ID code (order code: e5530H-230 GT).

## Reader

To read the e5530GT transponder, a reader unit is necessary. Such a reader has to supply a sufficient magnetic field. Further, it must detect and decode the damping of the transponder in order to read the ID code.

TEMIC offers the U2270B, which implements all important analog functions for such a reader unit.

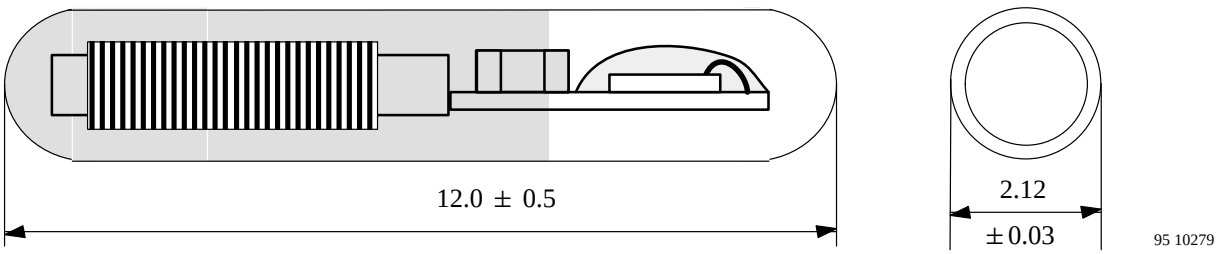
- Special coil driver for 5 V or 12 V
- Demodulator, input filter and amplifier to read Manchester or biphase transponder
- Microcontroller-compatible data output

## Reading Distances

The e5530GT is able to operate from very weak fields. Nevertheless, there are some general rules which influence the achievable reading distance.

- Best results are accomplished when the transponder points towards the reader coil.
- The transponder should not be embedded in metal, which will reduce the applicable magnetic field and thus the reading distance.
- The strength of the generated magnetic field and the sensitivity of the demodulator are the most important factors for a good reading distance.
  (A typical system with a small coil and a simple demodulator may reach ~3 cm, whereas a fully optimized system may reach up to 20 cm.)

# Dimensions in mm



## Ozone Depleting Substances Policy Statement

It is the policy of **TEMIC TELEFUNKEN microelectronic GmbH** to

1. Meet all present and future national and international statutory requirements.

2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

**TEMIC TELEFUNKEN microelectronic GmbH** semiconductor division has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively

2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA

3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

**TEMIC** can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.



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