1. Introduction

The TIRIS 23 mm Glass Encapsulated Pulsed FM Transponder is a key product in low frequency RFID systems that can be used for a variety of applications, such as automotive security systems.

The device is available in Read Only (RO) and Read/Write (R/W) versions. Electro Magnetic signals are used to power the passive (batteryless) device, to transmit the identification number to a reader unit or to program the device with new data. The basic principle is described in Figure 1.

Both RO and R/W versions use an 80 bit non-volatile memory (EEPROM) for storage of 64 identification bits and a 16 bit Block Check Character (BCC). The RO type is factory programmed with a unique tamperproof code that cannot be altered. The R/W version can be programmed by the user.

The 23 mm Transponder comprises a ferrite core antenna, a charge capacitor, a resonance capacitor and the integrated circuit (Figure 2). The antenna inductance and the resonance capacitor form a high quality resonant circuit.

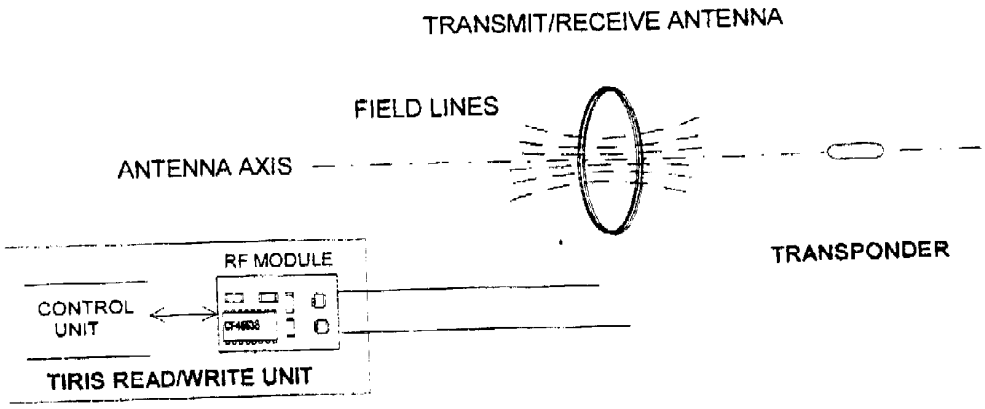

Figure 1: System Configuration Showing the Reader, Antenna and Transponder

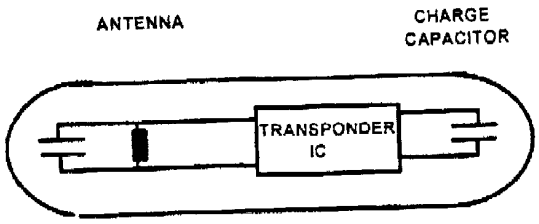

Figure 2: Block Diagram of the TIRIS Pulsed FM Transponder

2. Transponder Packaging

The dimensions of the transponder are given in Figure 3.

The 23 mm shape offers several advantages:

1. The transponder is hermetically sealed.
2. The transponder is robustly constructed to withstand vibration (IEC68-2-6) and shock (IEC68-2-6).
3. For Applications where read range is not the most critical point the transponder can be mounted or used in such a way that the orientation is not controlled.

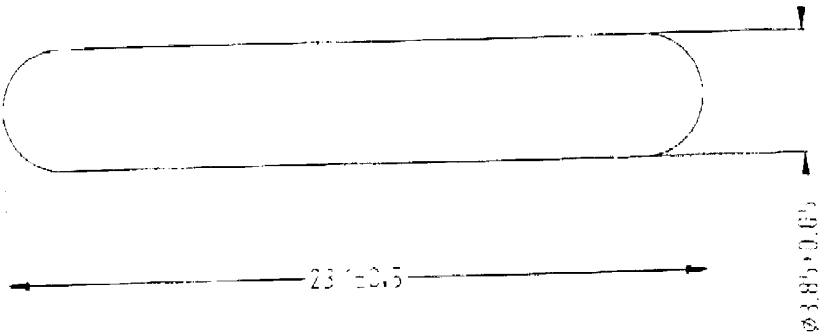

Figure 3: Dimensions of the TIRIS 23 mm Transponder (in mm)

3. Product Codes

64 bit Read Only device: **RI-TRP-RRHP**
64 bit Read/Write device: **RI-TRP-WRHP**

4. Function

The Pulsed FM System uses a sequential function principle separating the transponder powering (charge) and transponder data transmission mode. The advantages of the sequential mode are described in Section 5.1 "Basic System Data".

4.1 Read (Reading of RO and R/W Transponders)

During the charge (or powering phase) of between 15 and 50 ms the interrogator generates an electromagnetic field using a frequency of 134.2 kHz. The resonant circuit of the transponder is energized and the induced voltage is rectified by the integrated circuit to charge the capacitor. The transponder detects the end of the charge burst and transmits its data using Frequency Shift Keying (FSK), utilizing the energy stored in the capacitor.

The typical data low bit frequency is 134.2 kHz, the typical data high bit frequency is 123.2 kHz. The low and high bits have different durations, because each bit takes 16 RF cycles to transmit. The high bit has a typical duration of 130 µs, the low bit of 119 µs. Figure 5 shows the FM principle used. Regardless of the number of low and high bits, the transponder response duration is always less than 20 ms.

The data format consists of 128 bits. Different start/stop bytes and end bits are used, to allow secure distinction between RO and R/W Transponder. Figures 6a and 6b show the format of the received data for RO and R/W transponders.

After transmission of the data format the capacitor is discharged. The typical transponder readout timing is described in figure 4. The charge phase is followed directly by the read phase (RO mode).

Data encoding is done in NRZ mode (Non Return to Zero). The clock is derived from the RF carrier by a divide-by-16 function.

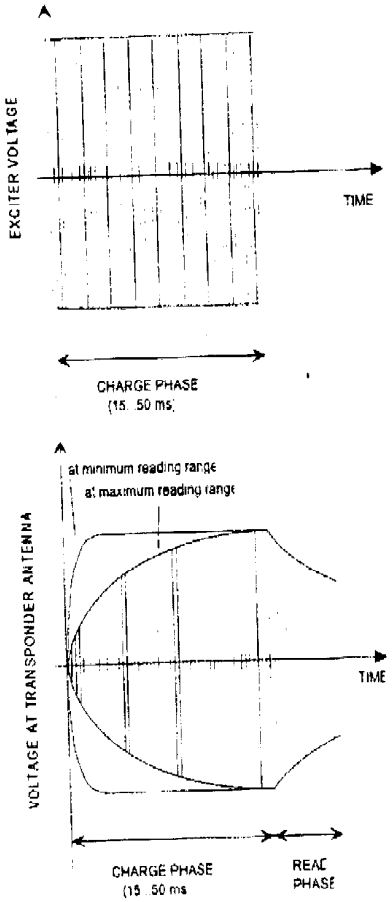

Figure 5: FM Principle Used for the Read Function of TIRIS Transponders

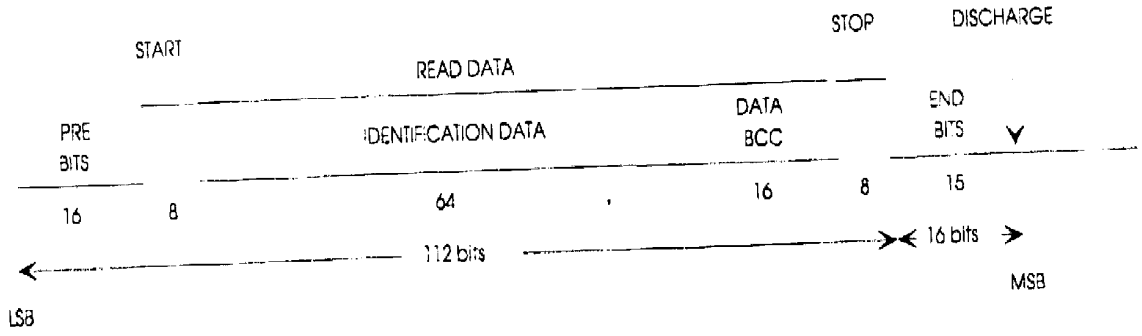

Figure 6a: Read Data Format of TIRIS RO Transponder

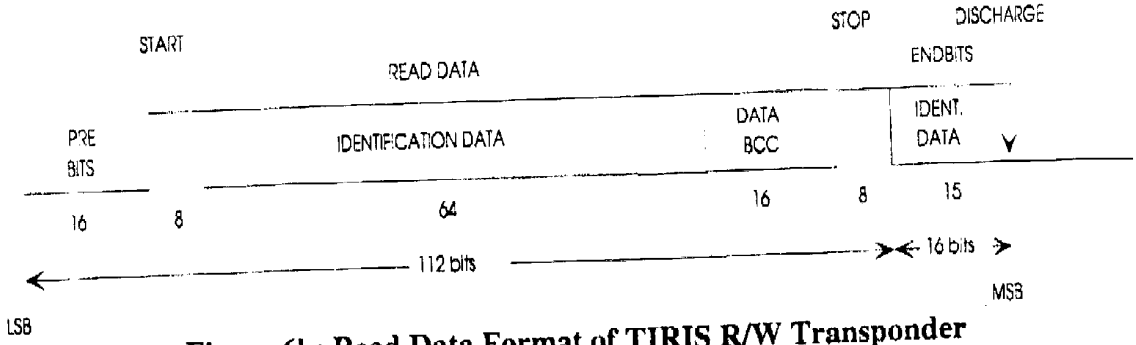

Figure 6b: Read Data Format of TIRIS R/W Transponder