![Texas Instruments logo] **TEXAS INSTRUMENTS**

Eco-Line 23mm Glass Transponder
RI-TRP-REHP (Read Only)
RI-TRP-WEHP (Read/Write)

Reference Guide

TI-RFid
A TEXAS INSTRUMENTS TECHNOLOGY

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Eco-Line 23mm Glass Transponder

RI-TRP-REHP (Read Only)
RI-TRP-WEHP (Read/Write)

Reference Guide

TEXAS
INSTRUMENTS

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Read This First

Edition One – September 2006

This is the first edition of this manual, it describes the following transponders and derivatives of 23mm Eco-Line Glass Transponder:

RI-TRP-REHP	23mm Glass Transponder Read Only
RI-TRP-WEHP	23mm Glass Transponder Read/Write

About This Guide

This guide describes the Read Only and Read/Write version of the 23mm Glass Transponder, and gives an overview of the most important specifications.

Conventions

> # WARNING
>
> **A warning is used where care must be taken or a certain procedure must be followed, in order to prevent injury or harm to your health.**

> ### CAUTION
>
> This indicates information on conditions that must be met or a procedure that must be followed, which if not heeded, could cause permanent damage to the equipment or software.

Note: Indicates conditions that must be met or procedures that must be followed, to ensure proper functioning of any equipment or software.

Information:
Indicates information that makes usage of the equipment or software easier.

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For more information, please contact the sales office or distributor nearest you. This contact information can be found on our web site at http://www.ti-rfid.com.

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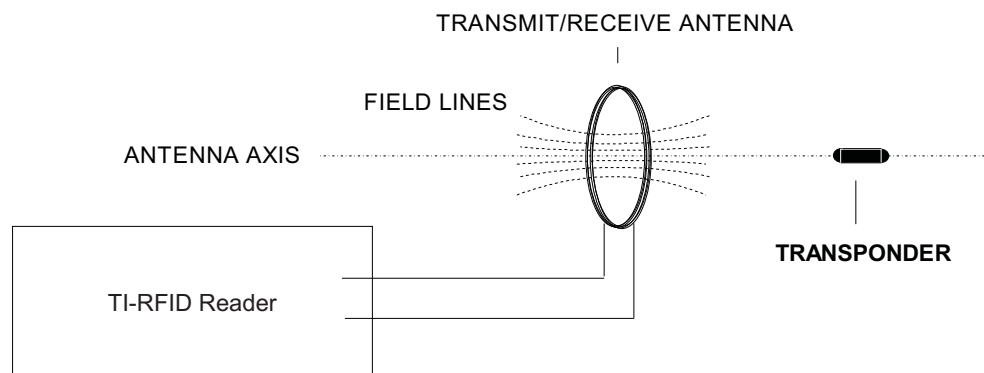TIRIS, TI-RFid, and Tag-it are trademarks of Texas Instruments.

Product Description

This chapter describes the RFID System and the functions of the 23mm Read Only and Read/Write Eco-Line Glass Transponder.

1.1 General

A RFID system comprises a reader, an antenna and a transponder.

TRANSMIT/RECEIVE ANTENNA

FIELD LINES

ANTENNA AXIS

TI-RFID Reader

TRANSPONDER

Figure 1-1. System Configuration

The reader and the transponder operate in a sequential mode with timely separated power and data transmission cycles.

1.2 Product Codes

Function	Product Code[1]	
Read Only	RI-TRP-REHP-xx	
Read/Write	RI-TRP-WEHP-xx	
Read Only	RI-TRP-REHP-3x	RoHs compliant
Read/Write	RI-TRP-WEHP-3x	RoHs compliant

[1] xx defines the revision

The Read Only type is factory programmed with a unique number.

The Read/Write version can be programmed by the user.

1.3 Functions

1.3.1 Read (Read Only and Read/Write Transponders)

During the charge (or powering phase) of between 15 and typically 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 charge phase is followed directly by the read phase (Read mode). After transmission of the data format the capacitor is discharged.

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 duration, because each bit takes 16 RF cycles to transmit. The high bit has a typical duration of approx. 130 μs, the low bit of approx. 120 μs. Figure 1-2 shows the FM principle used. Regardless of the number of low and high bits, the transponder response duration is always less than 20 ms.
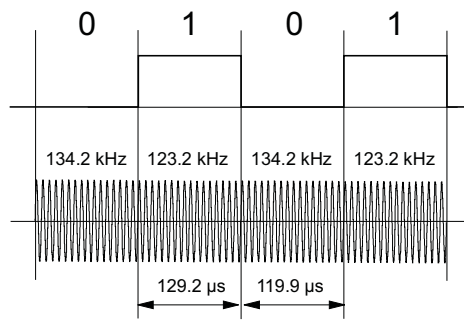
Figure 1-2. FM Principle Used for the Read Function of TI-RFid™ Transponders

The data format consists of 128 bits. Different start/stop bytes and end bits are used, to allow secure distinction between Read Only and Read/Write Transponders. Figure 1-3 and Figure 1-4 show the format of the received data for RO and R/W transponders.
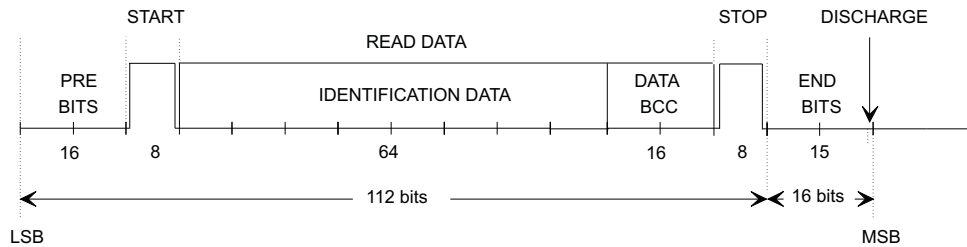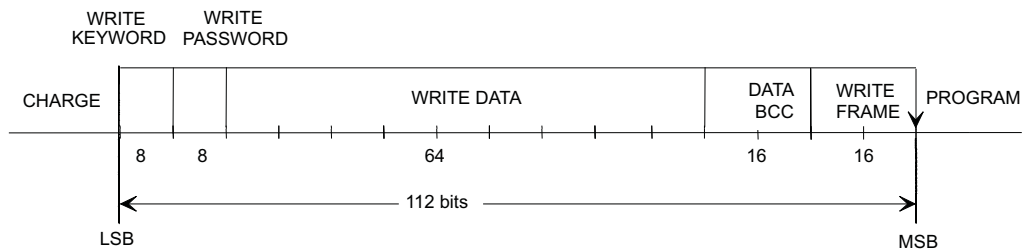

Figure 1-3. Read Data Format of Read Only Transponder
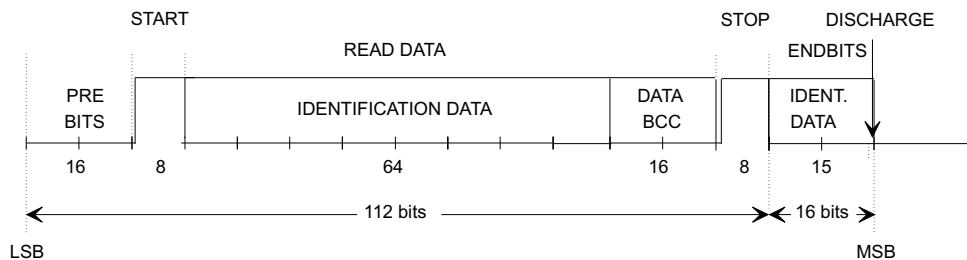
Figure 1-4. Read Data Format of Read/Write Transponder

1.3.2 Write and Program

A new identification number can be written (programmed) into a Read/Write transponder in the following manner: After the charge phase the R/W transponder enters the write mode providing the reader starts to modulate the field by switching the transmitter on and off. Modulation index of this amplitude modulation is 100%. The duration of the off-phase defines whether a low bit or a high bit is being transmitted (Pulse Width Modulation). Writing means, the transponder shifts the received bits into a shift register. After the write phase the reader's transmitter is switched on for a certain time (programming time) in order to energize the process of programming the shift register data into the EEPROM. All 80 bits are programmed simultaneously into the EEPROM. Once the data is programmed into the EEPROM the transponder automatically sends back the captured data to the reader to allow a security check, this process takes place when the transmitter is switched off. The 'Series 2000 Reader System RFM Sequence Control Reference Manual', document number 11-06-21-049 on http://www.ti-rfid.com describes the read/write procedure more detailed.

Figure 1-5. Write Data Format of Read/Write Transponder

Specifications

This chapter lists the operating conditions, electrical and mechanical characteristics and dimensions.

2.1 Mechanical Data

2.1.1 Dimensions

PARAMETER	LIMITS			UNIT
	MIN	TYP	MAX	
Length	22.6	23.1	23.6	mm
Diameter	3.8	3.85	3.9	mm
Weight	0.5	0.6	0.7	gr.
Case Material	Glass			
Protection Class	Hermetically sealed			

$\varnothing$ 3.85 mm ± 0.05 mm

23.1 mm ± 0.5 mm

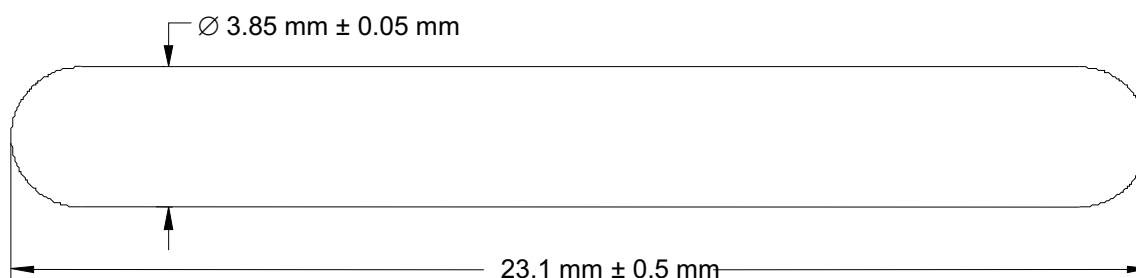**Figure 2-1. Dimensions of the 23mm Glass Transponder (Read Only, Read/Write)**

2.1.2 Vibration

Vibration test according IEC 68-2-6, test Fc.

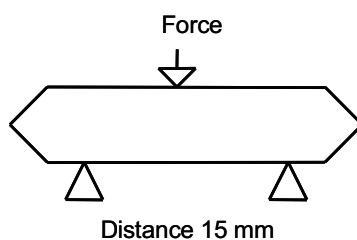| Conditions	Acceleration	10 g
	Frequency	10–500 Hz
	4 hours per axis	

2.1.3 Mechanical Shock

Mechanical shock test according IEC 68-2-27, test Ea.

Conditions	Acceleration	200 g half-sine
	Time	3 ms per axis

2.1.4 Break Force

Force

Distance 15 mm

Minimum force: 30 N
Force Built-up speed   20 mm/min

2.2 Electrical Data

2.2.1 Memory

PARAMETER	DATA
Memory size	80 bit
Memory organization	1 block
Identification data	64 bit
Error detection (Data BCC)	CRC – CCITT, 16 bit

2.2.2 Absolute Maximum Ratings

PARAMETER	LIMITS		UNIT
	MIN	MAX	
Operating Temperature (Read)	−25	70	°C
Operating Temperature (Write)	−25	70	°C
Storage Temperature	−40	85	°C
Storage Temperature (for total 1000 hours)		125	°C
ESD Immunity (IEC 801-2)	2		kV
EM Radiation Immunity 1 – 512 MHz	100		V/m
EM Radiation Immunity 512 – 1000 MHz	50		V/m
X-ray Dose at 110 kV		2000	RAD
Field Strength		220	dBµV/m

2.2.3 Recommended Operating Conditions

PARAMETER	LIMITS (50 ms CHARGE DURATION)			UNIT
	−25°C TO 70°C			
	MIN	TYP	MAX	
Charge frequency for read and write	134.16	134.2	134.24	kHz
Activation Field Strength (AFS)	192	188		dBµV/m
Programming time	15			ms
Programming Field Strength	196	193		dBµV/m
Operating quality factor	62			
Low Bit Frequency f_L	131.5		139.0	kHz
High Bit Frequency f_H	120.0		128.0	kHz
FSK Modulation index (read); $f_L - f_H$	9.0	11.0	15.0	kHz
Output Field Strength at d = 50 mm and using above AFS	132	133	156	dBµV/m
Programming cycles	10k			cycles

Note: The charge duration has an influence on the reading range and a reduction from the typical value (50 ms) to the minimum (15 ms) will result in a decrease of reading range.

Regulatory and Warranty Notices

3.1 Regulatory Notes

3.1.1 General

A transponders may be operated only under an experimental license or final approval issued by the relevant approval authority. Before any such device can be marketed, an equipment authorization must be obtained form the relevant approval authority.

3.2 Warranty and Liability

The "General Conditions of Sale and Delivery" of Texas Instruments Incorporated or a TI subsidiary apply. Warranty and liability claims for defect products, injuries to persons and property damages are void if they are the result of one or more of the following causes:

- improper use of the transponders
- unauthorized assembly, operation and maintenance of the transponders
- operation of the transponders with defective and/or non-functioning safety and protective equipment
- failure to observe the instructions during transport, storage, assembly, operation, maintenance and setting up of the transponders
- unauthorized changes to the transponders
- insufficient monitoring of the transponders' operation or environmental conditions
- improperly conducted repairs
- catastrophes caused by foreign bodies.

Terms & Abbreviations

The list of the abbreviations and terms used in various TI-RFid™ manuals can now be found in a separate manual:

TI-RFid™ Product Manual Terms and Abbreviations

Literature number SCBU014 (11-03-21-002)

TI-RFid™ Product Manuals – Series 2000 Reader System RFM Sequence Control Reference Manual

Document number 11-06-21-049

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