

# 686-52 Proximity Read Write Module Data Sheet

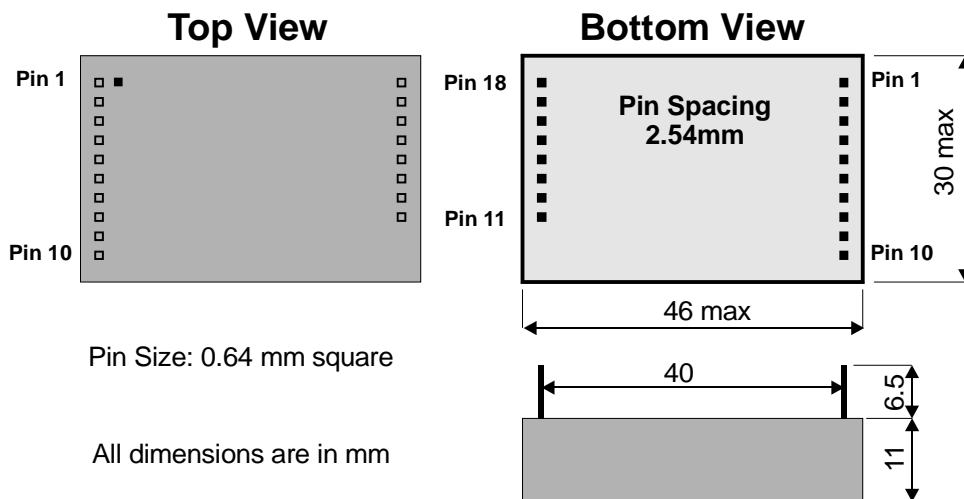
## 1 Introduction

The 686-52 **Read Write Module** is a fully encapsulated device for reading and writing to a range of contactless read/write identification devices or TAGS operating at a frequency of 125kHz. Correctly formatted cards will have a unique 40 bit ID and a user data area capable of storing 100 bits of data without password protection, or 80 bits of data with password protection.

## 2 Specifications

- Power requirements - either regulated 5V dc or unregulated 7 - 12V dc. Current consumption is 75mA typical.
- RF Frequency: 125 kHz.
- Read write tags supported: TEMIC e5550 series, Sokymat Q5, and equivalent devices.
- Control via full duplex RS232 (TTL levels) port at 19200 baud.
- Secure data encryption and decryption optional
- Support for password mode and answer-on-request.
- Typical reading range of internal antenna: tag with 20mm coil - 50mm, ISO card with 50mm coil - 90mm, half shell card with 65mm x 40 mm coil - 110mm
- Typical writing range of internal antenna: tag with 20mm coil - 40mm, ISO card with 50mm coil - 75mm, half shell card with 65mm x 40 mm coil - 90mm
- 3 general purpose output pins
- 3 general purpose input pins
- 1 open collector output for connecting a piezzo sounder (3.9 kHz)
- Operating temperature range: 0°C - +50°C.
- Weight: <30 grams.

## 3 Pinout Description & Dimensions



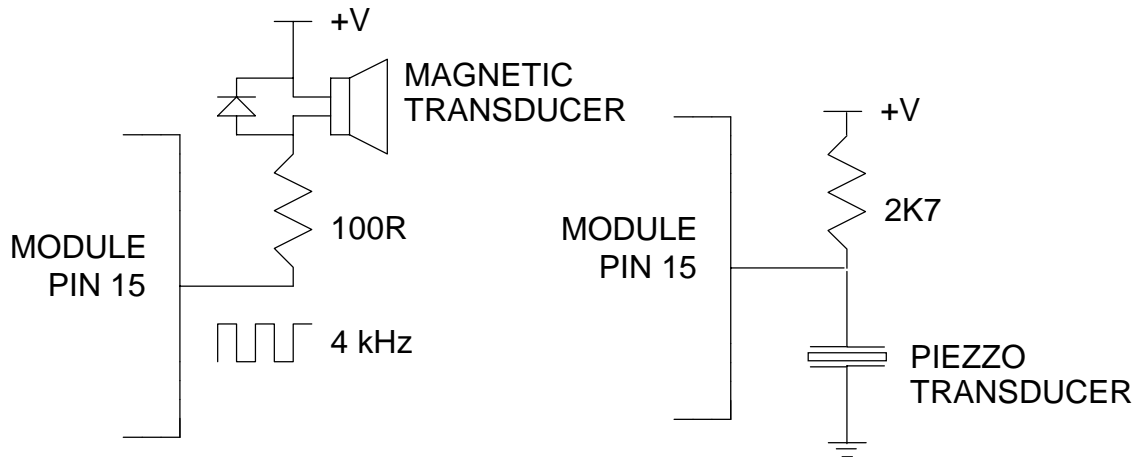
Pin #	Pin Name	Direction	Function	Conditions
1	OUT 3	OP	GP User output 3	5V TTL only
2	OUT 2	OP	GP User output 2	5V TTL only
3	TX OUT	OP	TTL Tx output	0 to 5V levels
4	RX IN	IP	TTL Rx input	0 to 5V levels
5	OUT1	OP	GP User output 1	5V TTL only
6	Reserved			Leave disconnected
7	IN 1	IP	GP User input 1	20mA
8	IN 2	IP	GP User input 2	20mA
9	IN 3	IP	GP User input 3	20mA
10	Reserved			Leave disconnected
11	COIL A	OP	External coil A	200mA
12	INT COIL	IP	Internal coil, link to COIL A	
13	COIL B	OP	External coil B	200mA
14	RAW DATA	OP	Outputs the raw data stream detected from the tag	10mA
15	BEEPER OUT	OP	Modulated open collector external piezo beeper output	50mA Note 2
16	+5V	IP or OP	+5V input/output	Note 1
17	+12V		+7-12V supply input	Note 2
18	0V	GND	Supply and port GND	

**Note 1.** The module may be powered by +5V directly using the +5V input, the User must ensure that this voltage does not exceed 5.5V or go below 4.5V.

**Note 2.** No reverse voltage protection is provided, either on the +12V or +5V connection, the user must add appropriate protection if required.

### 3.1 External Beeper Connection

The module pin 15 (BEEPER) is an open collector output. It outputs a frequency of 3.9 kHz for 60 ms when a tag is read. Typical circuits are:



### 3.2 External coil connection

The module has an internal coil which may be suitable for most applications. The internal coil is selected by connecting pin 11 (COILA) to pin 12 (INT COIL).

If an **external** coil is required to obtain a greater reading range, a coil of 486  $\mu$ H-508 $\mu$ H must be connected between pin 11 (COILA) and pin 13 (COILB). Pin 12 (COILLINK) must be left unconnected. No other external components are required.

### 3.3 General purpose outputs

Pins 7, 8 and 9 are 20mA CMOS outputs, available to the User, control is via a software command.

**Caution:** No internal current limit protection is provided on these outputs.

### 3.4 General purpose inputs

Pins 1,2 and 5, IN 1, IN 2 and IN 3 are general purpose inputs which can be read by the user via a software command.

**Caution:** Maximum voltage applied to these pins should not exceed 5V.

## 4 Tag memory usage

Temic e5550 series tags and Sokymat Q5 tags have 8 blocks of 32 bits of data and 1 lock bit per block. For these tags to work with this read write module these blocks must be used in the following way:

L	User data page 5/Password	Block 7
L	User data page 4	Block 6
L	User data page 3	Block 5
L	User data page 2	Block 4
L	User data page 1	Block 3
L	ID number (EM4001 format)	Block 2
L	ID number (EM4001 format)	Block 1
L	Configuration bits	Block 0

### 4.1 Block 0 - Configuration bits

This read write module cannot read or write to this block. The tag must have been configured by a card programmer for the following:

Bit rate = RF/64  
Manchester encoded amplitude shift keying (ASK)  
Block terminator = not used  
Sequence terminator = not used

Four other configurable options may vary according to the user's requirement:

Use password = ON or OFF.  
Maximum blocks = 2,3,4,5,6, or 7.  
Answer-on-request = ON or OFF.  
Obey Stop Command = ON or OFF.

If password is set ON then User data page 5 is no longer available as this block will contain the password. In this case Maximum blocks must exceed 6.

The maximum blocks setting will determine the number of blocks of data that will be transmitted by the tag when it is energised by the read write module's magnetic field. A minimum value of 2 is required so that the tag will always transmit blocks 1 and 2 which contain the ID number. Block numbers less than or equal to the Maximum blocks setting are referred to as **visible** blocks. Block numbers greater than the Maximum blocks setting are referred to as **hidden** blocks.

When Answer-on-request is ON the tag will only transmit when a WAKEUP command is issued with a valid password. Tags enabled for this mode should also have password mode enabled and the Obey Stop Command enabled. Only a tag with the matching password will wake-up. The Stop command can be used to silence the tag after it has been successfully read.

### 4.2 Blocks 1 and 2 - ID number

This read write module cannot read or write to blocks 1 and 2. The tag must have been programmed by a card programmer in such a way that blocks 1 and 2 contain a 40 bit ID number in EM4001 format. 64 bits are required to encode the 40 bit ID number in the EM4001 format. 10 bits are header and framing bits and 14 bits are parity bits.

### 4.3 Blocks 3-7 - User Data Blocks 1-5

This read write module's primary function is to read and write to these blocks. Each block can contain 20 bits of user data and is referred to as a user data page. The remaining 12 bits are used for framing and parity bits in a proprietary format. If the tag is configured to use a password then User Data Page 5 is not available as it is used to store the 32-bit password.

User data pages can be read in two ways. If the user data page is in a **visible** block then simply presenting the tag to the module will result in the ID number and all visible user data being read. If the user data page is hidden a specific Page Read command issued to the module will return the data. If password mode is enabled, then a password will be required to read the hidden data (Note that the Temic e5550/1/4 only supports a direct block read without a password!).

#### 4.4 Block 7 - Password mode

When password mode is set in the tag, block 7 must be programmed with the 32-bit password by a card programmer. The read write module cannot write a password to this block.

## 5 Encryption

### 5.1 What is encryption?

Encryption of the data is the transformation of the data to some other data by applying a 'key' and algorithm so that the new data 'appears' to be uncorrelated to the original data. Decryption is the reverse process to produce the original data if the key is known.

### 5.2 How it is applied

Encryption takes the User Data and encrypts it **before** writing to the TAG, **i.e the TAG contains encrypted User Data**. The **Read Write module** will always apply encryption/decryption on the User Data with the current key, this key is stored in non volatile memory in the Read Write Module and is used to both encrypt write data and decrypt read data. The key is set up once and is not required for subsequent reads and writes.

The ID number is not encrypted or decrypted.

An encryption key of 00000000 results in no encryption/decryption to the data. This is the default key.

The encryption key cannot be changed without the User knowing the current encryption key.

### 5.3 Encryption errors

If an encrypted TAG is read without decryption then the User Data is the encrypted data. If an encrypted TAG is read with the wrong encryption key then invalid User Data will be returned by the module.

## 6 User Commands

### 6.1 Command format

Commands and replies are sent in ASCII and are case sensitive, only keyboard characters are used. Data is sent as ascii chars. This means that a terminal program (Mirror, Term90, Procomm, Hyperterm, etc) can be used to send commands and receive replies. Commands are enclosed between a header, </> and a terminator, <enter> (carriage return). A comma is used as a separator where needed. The **Read Write Module** has a buffer which is cleared and starts filling after the header has been received, the command is processed after a terminator is received. All commands are replied to, the reply has no header and the terminator is a carriage return. For commands received and deemed invalid for any reason, or not completely processed, the Read Write Module will reply with CMDERR.

### 6.2 Command Set

Note. For ease of reading the commands are shown without the <enter> terminator.

#### 6.2.1 Query Version

/V?

Function: Outputs module firmware version information

Reply: VER=x.xx

Example: VER=1.00



3. READ=FAIL - some reading error
4. TAG=NONE - no tag in the field
5. CMDERR - command format error

Example: USER\_PAGE3=001A5

### 6.2.5 Write to User Data Page with or without password

/U<a>=<dddd>,<pppppppp>

where <a> is the User Data Page number 1,2,3,4 or 5.

<dddd> is 20 bits of User Data entered as 5 hex ascii chars.

<pppppppp> is optional and is the tag's 32 bit (8 hex ascii chars) password. If password protection is not used these bits are not required and will be ignored if sent

Function: The Read Write Module will write the User Data to User Data Page <a> to any TAG present in the field, encryption is applied according to the current key.

Reply: OK

**Note:** The read write module does not do any write verification, this must be undertaken by the User.

### 6.2.6 Control beeper

/B=<tttt>

where, <tttt> (in decimal ascii) is the time in ms that the buzzer is on.  
range 0<= tttt <= 9999 to be valid

Function: Turns on the beeper for tttt ms

Reply: OK

### 6.2.7 Query Magnetic Field State

/F?

Function: Outputs the state of the magnetic field of the **Read Write Module**

Reply: F=<x>

where <x> is magnetic field state, as ascii char

0=OFF

1=ON

### 6.2.8 Control Magnetic Field

/F=<x>

where: <x> is field state

0=OFF

1=ON

Function: Turns magnetic field either on or off

Reply: OK

### 6.2.9 Set General Purpose Output

/O<n>=<x>

where: <n> is the general purpose output number 1,2, or 3

<x> is the level

0=OFF(low)

1=ON(high)

Function: Sets level of output high or low

Reply: OK

### 6.2.10 Query General Purpose Output Pin Level

/O<n>?

Function: Returns the level of the general purpose output <n> where <n>=1,2, or 3

Reply: O<n>=<x> where <x> is current level, as ascii char

0=OFF(low)

1=ON(high)

### 6.2.11 Query General Purpose Inputs

/I?

Function: Returns the levels of the general purpose inputs

Reply: I=<xyz> where <xyz> is current level of input 1,2,3, as three ascii chars

0=OFF(low)

1=ON(high)

### 6.2.12 Answer on Request (Wake up)

/Q,<pppppppp>

where <pppppppp> is the tags's 32 bit (8 hex ascii chars) password in block 7.

Function: If a tag with Answer-On-Request enabled is in the field this command will return the ID number and any visible User Data.

Possible Replies:

- |  |                                    |
|--|------------------------------------|
| 1. TAG=dddddddddd                        | valid ID only                      |
| 2. TAG=dddddddddd,uuuuu                  | valid ID with 20 bits of User Data |
| 3. TAG=dddddddddd,uuuuuuuuuu             | valid ID with 40 bits of User Data |
| 4. TAG=dddddddddd,uuuuuuuuuuuuuuuu       | valid ID with 60 bits of User Data |
| 5. TAG=dddddddddd,uuuuuuuuuuuuuuuuuuuuuu | valid ID with 80 bits of User Data |
| 6. TAG=dddddddddd,x                      |                                    |
| 8. TAG=NONE - no tag in the field        |                                    |
| 9. READ=FAIL - not a valid tag in field  |                                    |

where ddddddddd is the 40 bit ID number displayed by 10 ascii characters

uu...uu is 20,40,60,80 bits of User Data displayed by 5,10,15, or 20 ascii characters

'x' indicates invalid User Data displayed as an ascii character

### 6.2.13 Stop

/S<x>

where <x> is 0 for sending a Temic 'stop' command (opcode 11)

1 for sending a Sokymat Q5 'modulation defeat' command (opcode 00011)

Function: Transmits the STOP command which will silence any tags that have the OBEY STOP COMMAND feature enabled.