Dual Interface EEPROM

Product presentation
December 2011
Dual Interface EEPROM – Introduction

- New MCU control function
- Low-power I2C interface
- RFID and NFC compatible RF interface
- Unique Energy Harvesting Function
- High-reliability EEPROM

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Enabling a wide range of use cases…

MANUFACTURING & LOGISTICS
- Parameter setting
- Activation key
- Factory settings
- In-line calibration
- Traceability
- Dual RFID
- NFC

Dual Interface EEPROM
- Event Log
- Calibration
- Traceability
- After Sales
- Warranty management

END USER
- User setting profile
- Usage/load information
- Datalogging
- Personalization
- Warranty management
- Wireless pairing

SERVICING & MAINTENANCE
- In-line calibration
- Traceability
- Warranty management
Dual Interface EEPROM - Concept

Read and write parameters from *inside* (I²C) and *outside* (RF) the application
Based on Passive RFID technology
- Just add a 13.56 MHz inductive antenna onto your PCB

No battery needed to operate the dual interface EEPROM in RF mode
Dual Interface EEPROM: targeted applications

Industrial
Medical
Metering
Factory automation

- Calibration
- Parameter update
- Diagnostics
- Maintenance
- Asset tracking
- Activation

Peripherals, Communication, Consumer Electronics

- Parameter update
- Diagnostics
- Maintenance
- Traceability
- Asset tracking
- Activation

Smart sensors, RFID

- Data loggers
- Identification
- Traceability
- Sensors/cold chain

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Dual Interface EEPROM…
New perspectives for parameters management

Wireless access

- Operating data
- User settings
- Traceability information
- Application data
- Event log
- Identification data

With 32-bit password protection

Ideal for product configuration management!
Dual Interface EEPROM…
Convenient zero-power RF data download

Ideal for portable devices such as healthcare and wellness products!

On-The-Go Data Download

Pedometer

Pulse Oximeter

Thermometer

M24LR64 Inside

CPR card

Glucose Meter

Fitness watch

Patient Monitoring

Weight Scale

Home or Hospital Data Analysis

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Dual Interface EEPROM...
Improved consumer experience

New innovative use cases for consumer and home appliance products!

Use smartphone for data processing and user-friendly interface

- User Manual’s URL
- Usage / load information
- Power consumption history
- Warranty information
- Date of purchase
- User profile setting and reading
- Model ID
- Event recorder/temperature log
- Calibration data
Dual Interface EEPROM...
Improved customer service

Static information
- Model ID
- Serial Number
- Manufacturing plant
- Date code
- BOM version
- Firmware version

Dynamic information
- Tamper detection information
- Incidents/defaults logs
- Tracking of critical components
- Last maintenance records

RF operations working even when device powered off!
Dual Interface EEPROM…
Enabling battery-less applications

Innovative energy harvesting function enabling battery-less designs!

A few mA at ~2V delivered to your MCU and other components

New M24LR16E
Dual Interface EEPROM - benefits

- Product configuration management
- Extended battery lifetime
- Battery-less designs
- Improved customer service
- Improved consumer experience

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Dual Interface EEPROM conclusion

Innovation based on 2 industry-standard protocols

Enables cost reduction and flexibility at all product life steps

If you would like more details, go to the next slide
Product Features
M24LR64 block diagram

I²C interface
- industry standard
- 1.8-5.5V, 400kHz

ISO 15693 RF interface
- industry standard
- passive RFID technology
- high-speed mode (up to 53 Kbit/s)

Power management and PC/RF arbitration unit

64-bit UID
- 64-bit Unique Identifier
  (Factory-Programmed and Locked)

EEPROM
- 64-Kbit EEPROM
- Password protection scheme

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External power supply

I²C interface

RF WIP_BUSY
(Digital output)

Vout
(energy harvesting from RF)

ISO 15693
RF interface
Antenna Integration
Antenna integration

**On-board**
- **Pros**: Integrated and compact solution
- **Cons**: Probably less space available on the PCB for a large antenna. Read range may then be smaller

**On-board inductor**
- **Pros**: Small footprint, Standard component (4.7µH), Small design effort
- **Cons**: Limited read range, More sensitive to orientation vs reader antenna

**Off-board or Daughter board**
- **Pros**: Antenna may be placed closer to the outside of the device, Larger antenna may be designed, Eventually, better read ranges, A 2-layer PCB is good enough
- **Cons**: Unless the antenna is connected, the M24LR64 may not be accessed in RF mode
Designers support – antenna design

- There are other options for integrating the antenna into your PCB. An example is « surrounding antenna »
- Contact your ST technical support for specific antenna design support

Surrounding Antenna
Designers support - antenna integration

- ST provides documents helping customers design the antenna by themselves
  - Application note
    - AN2972 Designing an antenna for the M24LR64-R dual interface
    - AN3178 Using a surface-mount inductor as M24LR64-R antenna
  - Software
    - Executable meant for computing a 13.56 MHz antenna
  - Reference designs
    - ROBOT-M24LR16E-A
    - ANT1-M24LR16E
    - ANT2-M24LR16E
    - ANTx-M24LR-A
RF reader-writers
4 types of RF reader-writers

- Commercial ISO15693 RFID reader-writers, available through partners
- ST’s 13.56MHz transceiver IC for embedded RF reader-writer
- Mobile phones with ISO15693 capable NFC function
- ST’s evaluation kits for evaluation / development
Commercial RF reader-writers

- ISO15693 standard at 13.56 MHz - Firmware upgrade might be required
- Exists in various form factors providing wide range of price and performance

Check out the video at www/st/com/edemoroom
(Play « Dual Interface EEPROM RF technology »)
Commercial RF reader-writer partners

- ST is developing a network of reader partners, which are supporting the M24LR64.

- More information available at www.st.com/dualeeprom
Embedded reader-writer: CR95HF chip

- ST ISO15693 products will be supported by the CR95HF with
  - Software libraries
  - Reference design
  - Application notes

- Host controller
- Optional AES Encryption Library (e.g. STM32 UM0586)
- ISO15693 Memory Library
- UART
- SPI

- M24LR64, M24LR16E
  - 64-Kbit and 16-Kbit Dual I/F EEPROM

- LRi1K, LRi2K, LRiS2K
  - 1 and 2-Kbit ISO15693

- LRiS64K
  - 64-Kbit ISO15693 w/ password protection

- Other ISO15693
  - Support of other ISO15693 devices

Design your own embedded RF reader-writer
CR95HF with Dual Interface EEPROM

Enabling innovative interactive data exchange

Main-unit or reader-writer

- MCU
- CR95HF
- SPI

Memory with Dual Access

- M24LRxx
- I²C

New Application

- MCU
- Display
- Touch keys
- Sensors

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CR95HF technical support

CR95HF drivers (ANSI C)
- Source code CR95HF drivers v1.0.rar
- Application note AN3355

Schematics and gerber files
- Schematics (0017031-B-SCM.pdf)
- Gerber files (0017031-B-Gerber.zip)

PC demonstration software
- M24LRxx Application Software 2.0.zip

Antenna design guidelines
- Application note AN3394
- Antenna design simplified basic tool

DEMO-CR95HF-A
CR95HF ordering information

**Product Type**
- CR=Contactless reader IC

**Wired Access**
- CR95HF

**Frequency Band**
- HF=High Frequency (13.56MHz)

**Operating Voltage**
- V: 2.7V-3.3V

**Package**
- VFQFPN32 5x5 mm

**Operating Temperature**
- 5: -25C / +85C

**Tape & Reel**
- MD5T

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NFC: mobile phones as RF reader-writers

Compatible with ISO15693-capable NFC phones
Dual EE NFC Android App

- Dual EE app on the Android market
- Source code at www.st.com/dualeeprom

Works with DATALOG-M24LR-A reference design
Nfc-Vreader Android App

- Reader-writer application
- Works with ISO15693 products
- Contact your local sales team for support
Evaluation Kits
Designers support
Development kit – “DEVKIT-M24LR-A”

NB: SDK dll source files available for Windows for free. Charges apply for other platforms such as .Net, Java,…
Designers support
Starter kit – “STARTKIT-M24LR-A”

NB: basic dll source files available for Windows only
Designers support
Evaluation kits summary

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Evaluation, proof-of-concept</th>
<th>Development, advanced evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF operating distance</td>
<td>Up to 8 cm*</td>
<td>Up to 40 cm*</td>
</tr>
<tr>
<td>RF and I²C communication speed</td>
<td>Slow</td>
<td>Fast</td>
</tr>
<tr>
<td></td>
<td>read 64k-bit : 1'24”</td>
<td>read 64k-bit : 0'08”</td>
</tr>
<tr>
<td></td>
<td>write 64k-bit : 5’34”</td>
<td>write 64k-bit : 0’31”</td>
</tr>
<tr>
<td>RF capabilities</td>
<td>1 tag at a time</td>
<td>Multi-tag capability</td>
</tr>
<tr>
<td>Software</td>
<td>Windows dll source code</td>
<td>Windows SDK for free</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(others platforms SDK with charge)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FEIG download access code available</td>
</tr>
<tr>
<td>Ordering information</td>
<td>STARTKIT-M24LR-A</td>
<td>DEVKIT-M24LR-A</td>
</tr>
</tbody>
</table>
Reference Designs
A wide range of antenna boards...

Contact your local ST sales team for more details
M24LR64-R Datalogger reference design

- DATALOG-M24LR-A is a complete reference design with
  - Hardware design (including antenna design)
  - MCU firmware (STM8L)
  - PC software

Turn-key data logging design

DATALOG-M24LR-A
M24LR64-R Datalogger reference design

- Demonstrates the use of the M24LR64 in a data logging application (medical, industrial sensors, …)
- Helps customers get started with their RFID-enabled datalogger design
- Can be extended to also sense shocks/vibrations, pressure, light…

DATALOG-M24LR-A

Demonstration software

Supporting material
M24LR64-R Datalogger supporting material

- **AN3209 Application note**
  Developing your M24LR64-R datalogger application for temperature acquisition

- **UM0925 User Manual**
  Using the M24LR64-R datalogger reference design

- **Gerber files** for M24LR64-R datalogger

- **Firmware** for the STM8L101 Microcontroller

- **Source code**

- **Demonstration** **PC software**

The M24LR64-R Datalogger supporting material can be downloaded at [www.st.com/dualeeprom](http://www.st.com/dualeeprom)
Ordering Information
Dual Interface EEPROM
Nomenclature for package delivery

M24 LR 16E-RMN6T/2

- **Serial Interface Type**: M24 : I2C interface
- **RF Interface Type**: LR: Long range / 13.56MHz - ISO 15693
- **Operating Voltage**: R: 1.8V-5.5V
- **Memory Size**: in user $K$ bits
- **Operating Temperature**: 6: -40C / +85C
- **E**: energy harvesting
- **Package**: SO8 (MN) 150 mils width
- **Internal Tuning Capacitance**: Tape & Reel: 2: 27.5pF
- **Package Dimensions**: UFDFPN8 (MB) 2 x 3 mm
M24 LR 64-RS185/2

Serial Interface Type
M24: I2C interface

RF Interface Type
LR: Long range / 13.56MHz - ISO 15693

Memory Size
in user $K$ bits

Operating Voltage
R: 1.8V-5.5V

Package
2: 27.5pF

Internal Tuning Capacitance

S/Z: Sawn wafer on metallic frame and UV tape (inkless/inked)
1: wafer orientation in frame
8: wafer size in inches
5: wafer thickness = 140μm
M24LR64-RS185/2 – die format

- M24LR64 chip in die form (meant for wire bonding technology)
- Ultra thin: 140µm thickness +/-10µm
- Sawn wafers on UV tape and 8” ring
  - S version: bad chips identified by electronic wafermap (« STIF » format) provided by ST
  - Z version: bad chips identified with ink dots on wafer
- 6 months lifetime @25 degC (UV tape limited)
- Production Minimum Ordering Quantity (MOQ) is 5 wafers, i.e. approximately 42.5ku

See TN0185 for complete die form delivery information