



FTF 2016
TECHNOLOGY FORUM CHINA

一触即连(NFC Pairing)

FTF-MHW-N2328

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2016年9月29日

PUBLIC USE



日程表

- 简介: NFC技术与背景, 应用与主要特征
- 目前NFC设备的通信原理
- 两款用于NFC 配对连接的芯片介绍,PN7150与NTag12C
- 应用NFC标签配对连接的过程
- 总结

NFC

背景，应用与主要特征



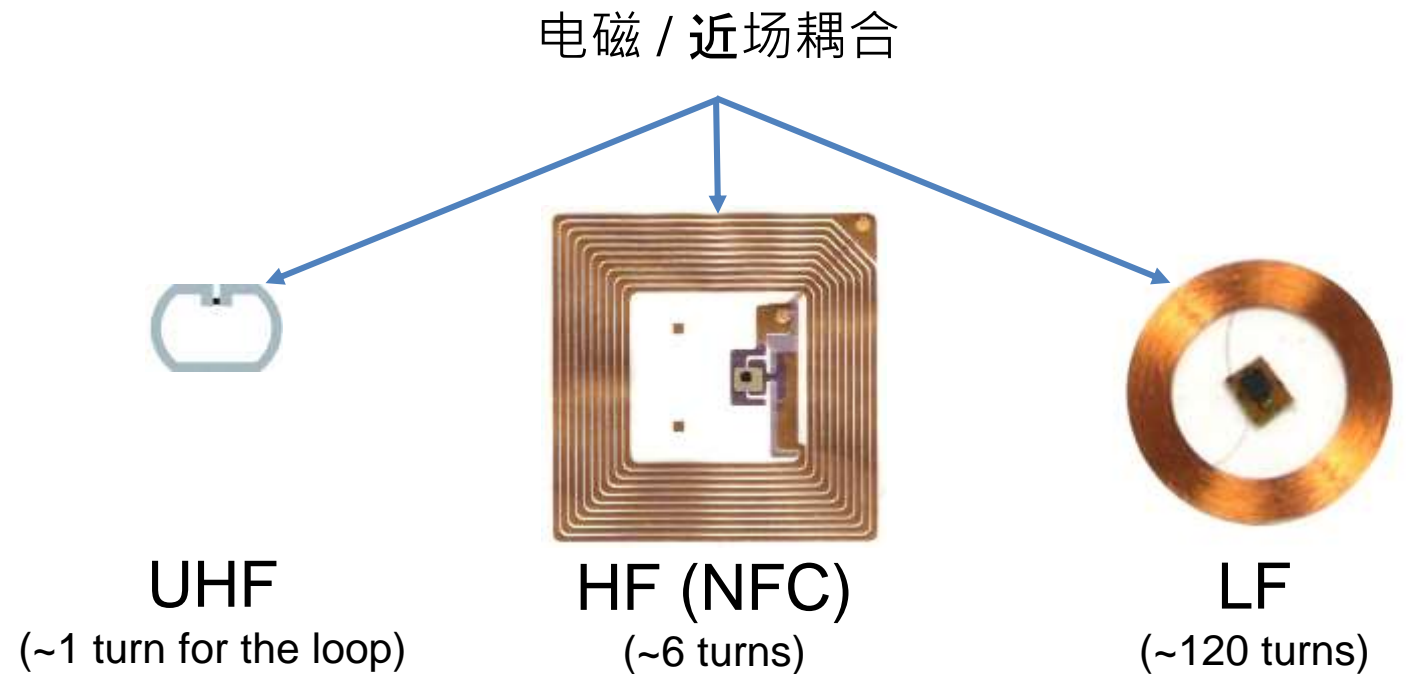
什么是NFC？

近场通信是一种短距离无线连接**技术标准**，主要设计用于两个电子产品间**自然而简单**的通信。



无源RFID标签

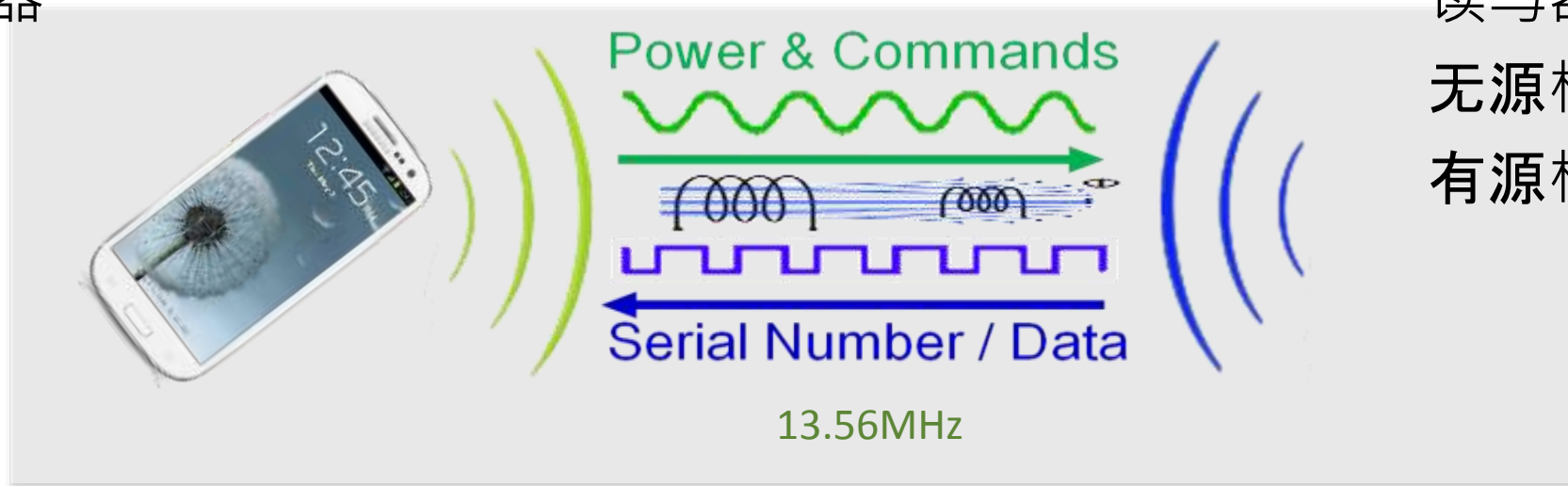
- 类似于具有唯一序列号的无线存储盘 (可读写)
- 主要的三个工作频段：
 - 低频 (LF-125kHz)
 - 高频 (HF-13.56 MHz)
 - 超高频 (UHF-840 - 960 MHz)
- 主要讨论频段：
 - 高频 (HF/NFC)



NFC | 工作原理

- 与RFID, 非接触式智能卡, 门禁卡基础工作原理一致
- 读写设备 (例如, 移动设备) 提供能量, 发起RF通信并捕捉从标签来的数据 (或者给标签写入数据)

读写器



RFID, Proximity & NFC

我们经常听到这些术语，但是每一个术语具体涵盖哪些内容？



RFID: 射频识别

- 无线技术通用术语.
- 通常指与货品或单品标示的相关的应用
- 识别距离从几厘米到几米 – 自动侦测唯一标识码(几个字节)
- 基于不同的技术: LF (120-150 KHz), HF (13.56 MHz), UHF (433 to 900 MHz)
- 标准化, ISO18000

非接触近场技术

- RFID的子集, 局限于一个频段: 13.56 MHz. 用于人, 需要主动动作 (将卡置于读写器前)
- 用于: 门禁控制, 电子护照, 支付, 交通等
- 更多的存储空间, 更高的安全性
- 短距离 (几厘米)
- 标准化: ISO14443

NFC: 近场通信

- NFC 由非接近场技术衍生而来, 拓展了点对点 和卡模拟功能
- 短距离
- 标准化: NFC 论坛 (NFC Forum)

NFC 发展大事记

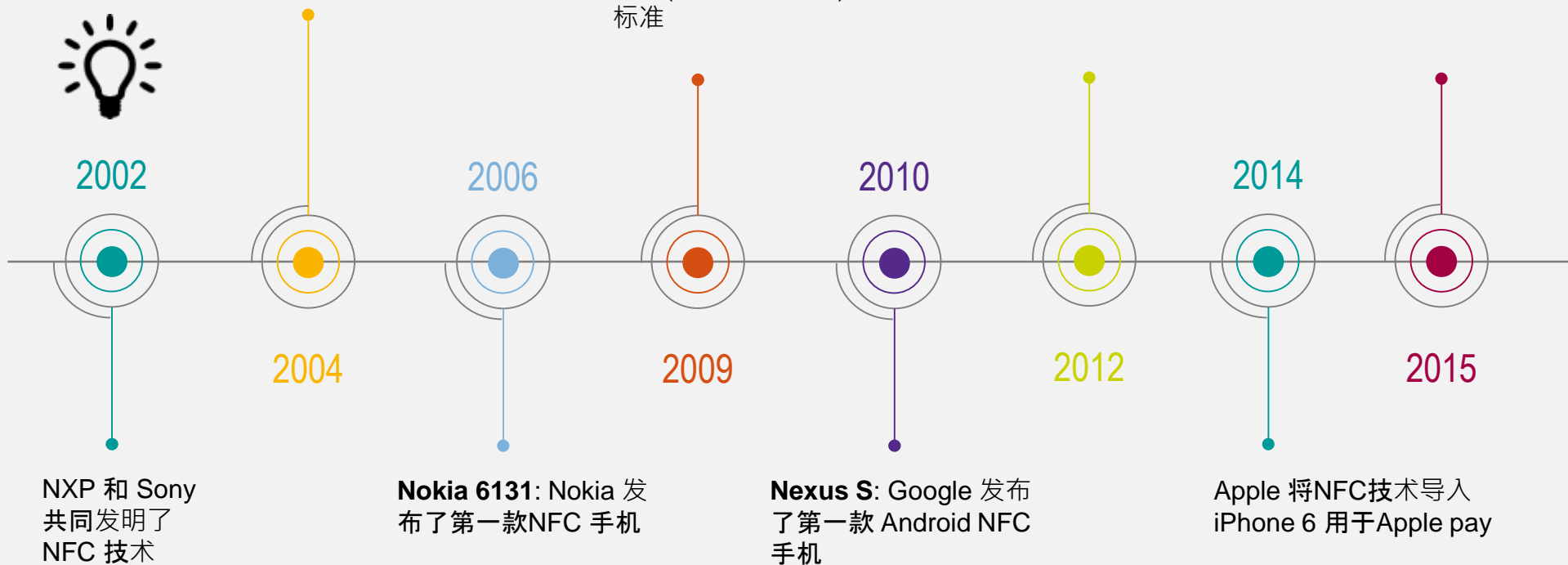
NXP 联合创建NFC Forum, 领导行业内不同的利益相关者协同工作, 并助力标准化工作

NFC Forum 发布点对点 (Peer-to-Peer) 标准

Sony和Samsung 驱动·智能标签市场井喷

NXP 出货达到10亿片·用于智能手机安全NFC交易

NXP 因NFC获得欧洲发明奖的殊荣



以下网址可获得更多的NFC最新资讯

[NXP me & my smarter world](#)

NFC – 三种应用模式



读写模式

- 与NFC设备交互
- 从设备读取数据或写入数据



获得信息或发起动作



点对点模式

- 两个NFC设备建立双向通信
- 每个设备都是一个节点



被动和主动通信，例如配对



卡模拟模式

- 系统功能如同一张非接触智能卡*
- NFC系统和现有的非接触卡片系统兼容



票务，支付，门禁，控制，交通...

* ISO/IEC 14443-兼容智能卡

NFC 在手机里的应用

支付
手机= 销售终端
(POS)



交易
乘坐公共交通
手机 = 公交卡

发现服务
从海报获取信息:
手机 = 票务机



交易
小额支付
手机= 信用卡

交易
门禁控制:
手机 = 钥匙



连接
信息交换
手机= 电子名片



NFC 在电脑和消费类电器类的应用



交易
安全支付



连接
快速安全的建立
无线网络或蓝牙



连接
快速, 方便得长距离数据
传输



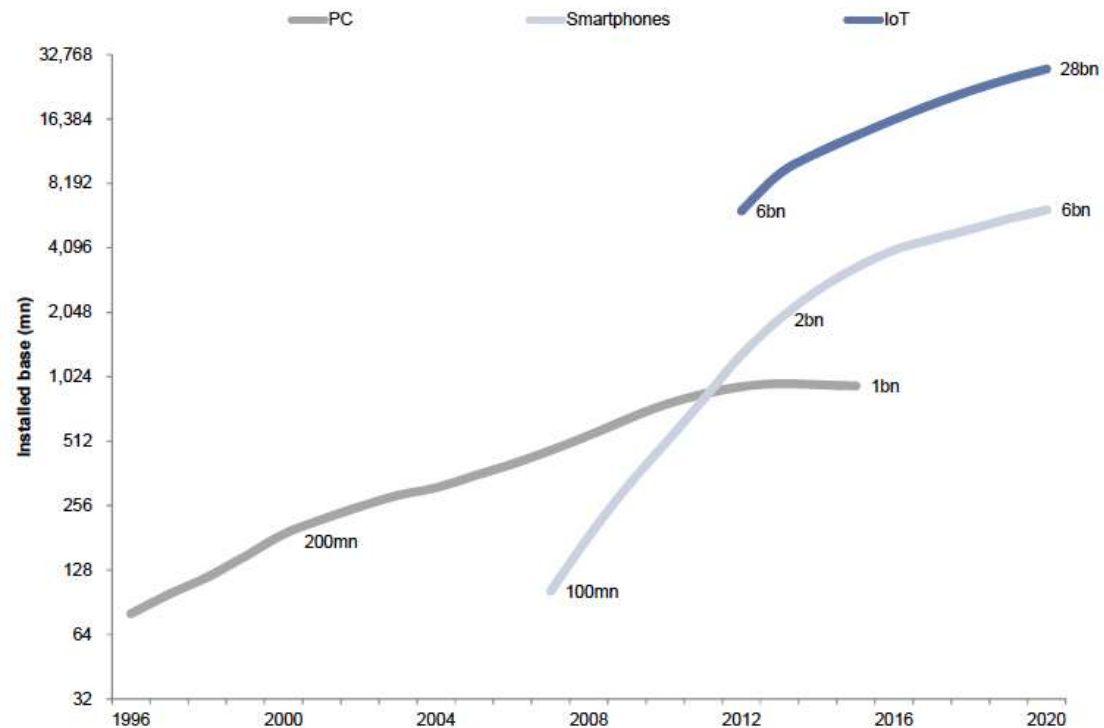
NFC 在物联网中的接受情况 (IoT)



Exhibit 4: IoT emerging as the next mega-trend

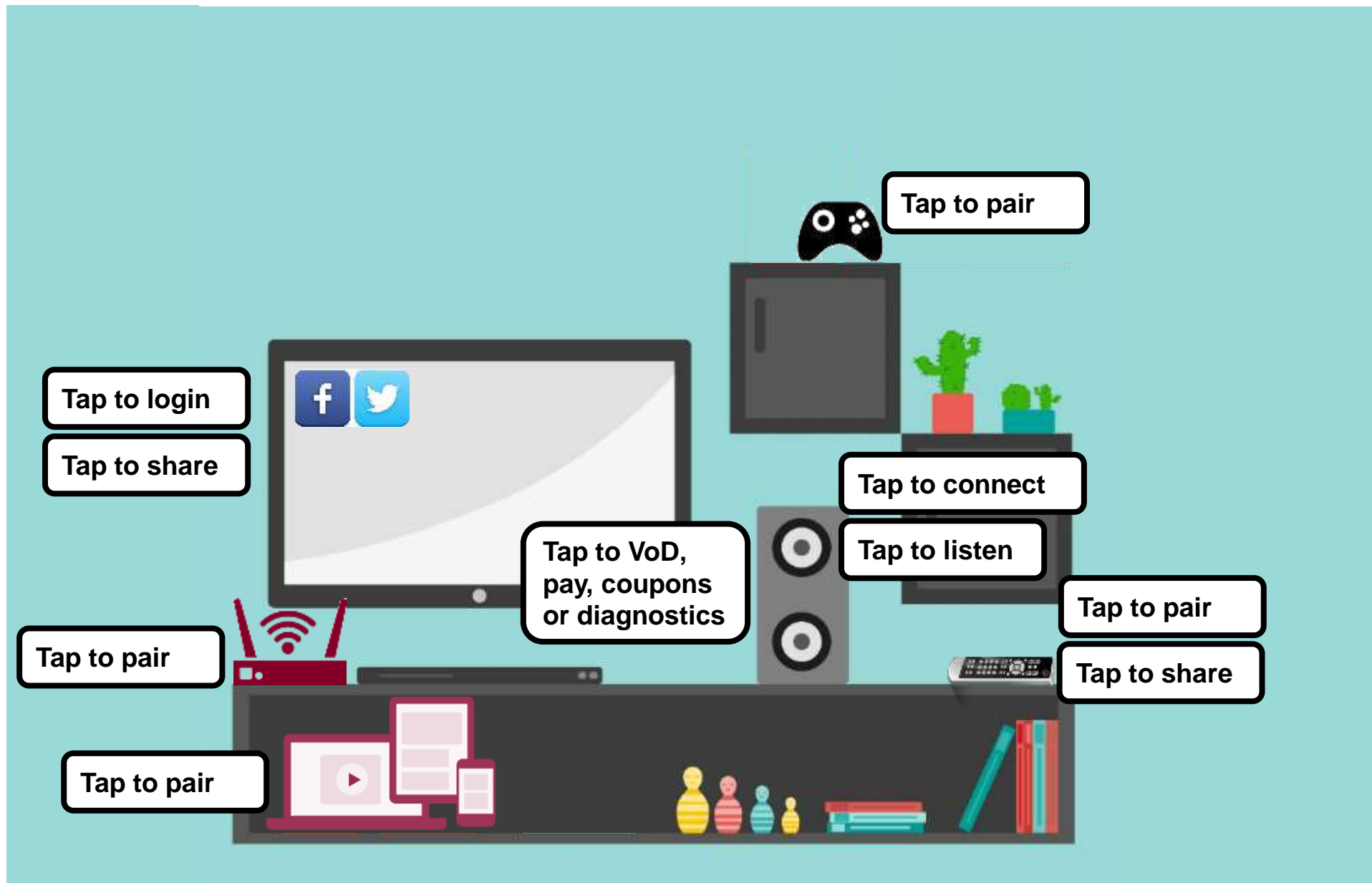
Internet subscribers over time

Note: y-axis is on a logarithmic scale



Source: IDC, Ericsson, Goldman Sachs Global Investment Research.

接入家庭网络&物联网



瞬时配对扬声器，耳机或音响

- 和声频设备蓝牙或无线网络配对/解除配对，相较按键方式，快20倍
- 扬声器间互相配对 (不需要智能手机)，建立真正的无线立体声系统
- >20 成功案例



便于集成

需要手机

无需后端

无需认证



家庭网关：平顺、安全的接入

- 最佳最终用户体验:

- 新颖的瞬时注册
- 无供电要求
- 无手动介入

- 安全（近场）信任数据交换
- 涵盖各种智能网络

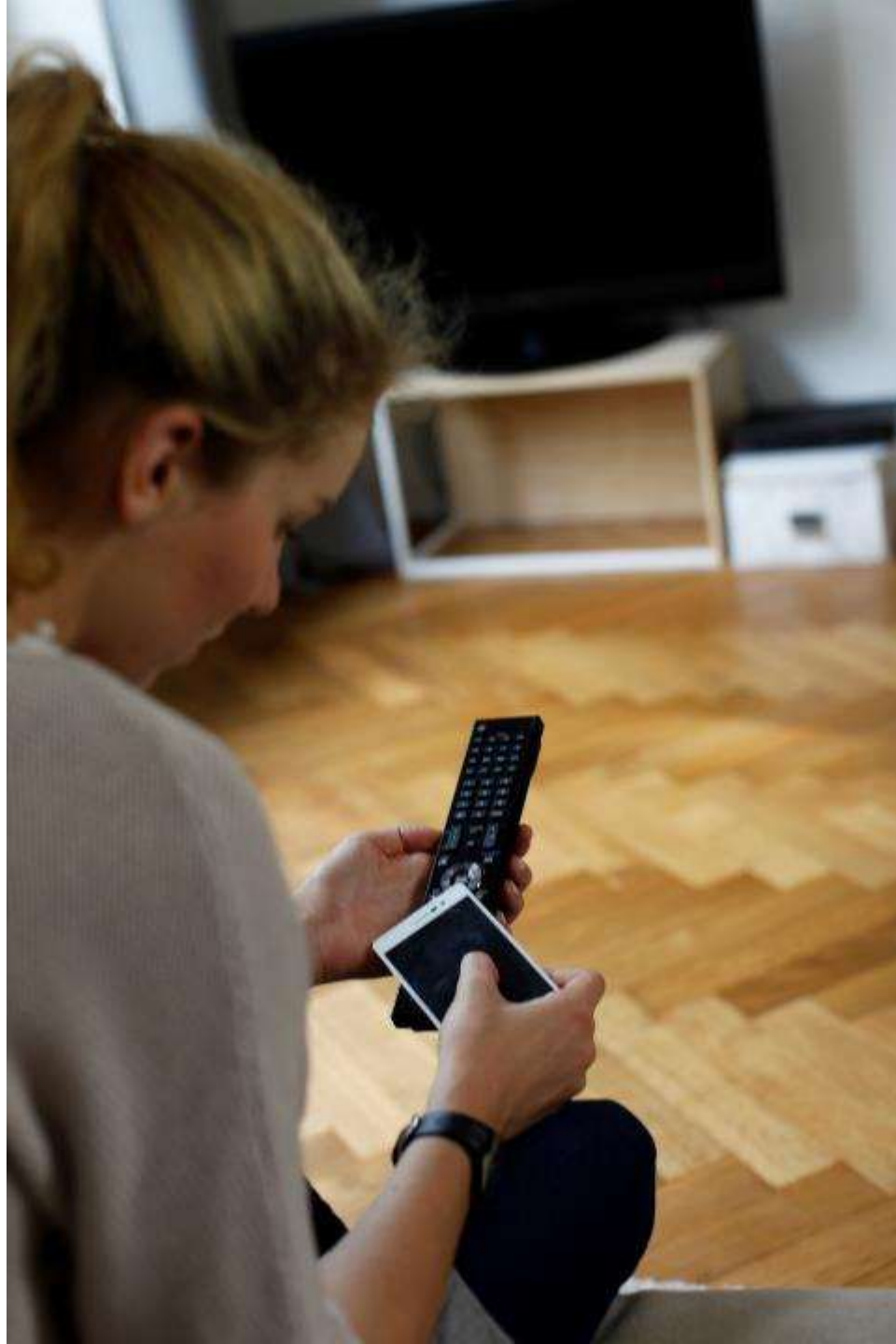


易于集成

需要手机

需要后端

无认证要求



各种手持设备对接入家庭设备

- 轻轻碰触，轻松配对接入蓝牙和无线网络
- 无需输入长密码
- 配对相机，头戴式耳机，电子读写器，平板电脑到打印机，网关，路由器，机顶盒，智能电视及其它

Picture to be added



易于集成



无需手机



无需后端



无需认证



NFC设备的类型

NFC 技术一览

- 非接触近场技术
- 工作频率：13.56 MHz
- 操作距离: 10 cm
- 最大速率: 848 Kbps (106 Kbps)
- 标准化 ISO/IEC, ECMA and ETSI.
- 兼容现存的ISO/IEC 14443 和 FeliCa 非接触式智能卡和读写器设备
- 读写, 卡模拟和点对点方式可在同一设备全部实现
- 快速, 无缝和蓝牙, Wi-Fi配对
- NFC Forum 是核心标准化和交互的工作组织

读写模式: 如同非接触式读写器

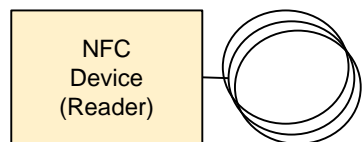


无源标签: 如同无线存储器 EEPROM

主动标签: 如同拥有一个串行接口的无线存储器 EEPROM



NFC 通信方式 读写器/标签 被动通信方式



1. Power

The RF field oscillates at 13,56MHz.
The card is powered through the electromagnetic coupling



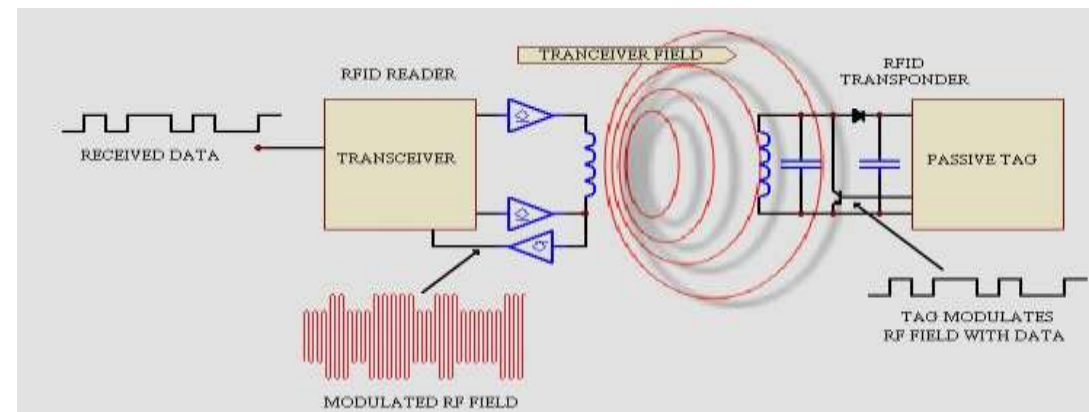
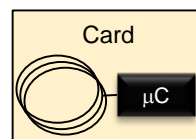
2. The Reader sends commands

The Reader modulates its RF field to send commands



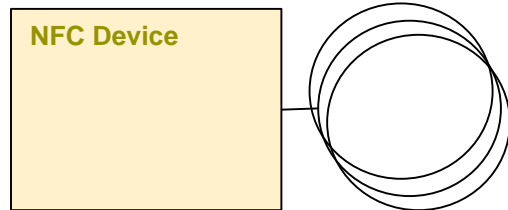
3. Answering to the Reader

By modifying its consumption, the chip modifies the RF field, which is detected by the Reader (Load Modulation)



点对点无源 通信模式

Initiator



1. The Initiator generates the RF field

This field is used to exchange the data. Both Initiator and Target are powered internally



2. Sending commands

The Initiator modulates the RF field to send commands



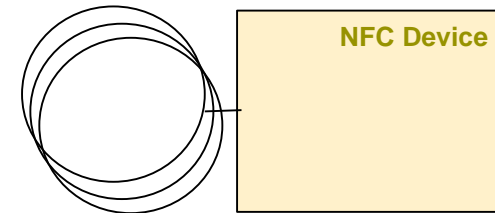
3. Target answers

Similar to the card case, the Target will use a "backward Modulation" to transmit its answer.

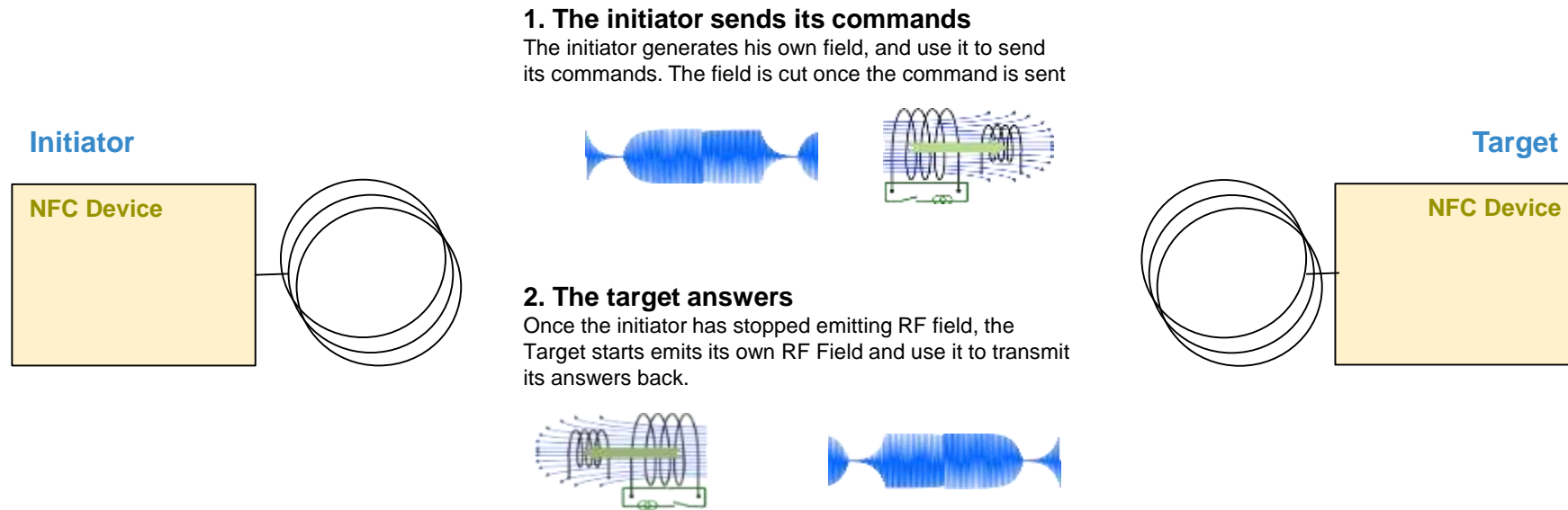


Same concept as for the Read/Write mode

Target

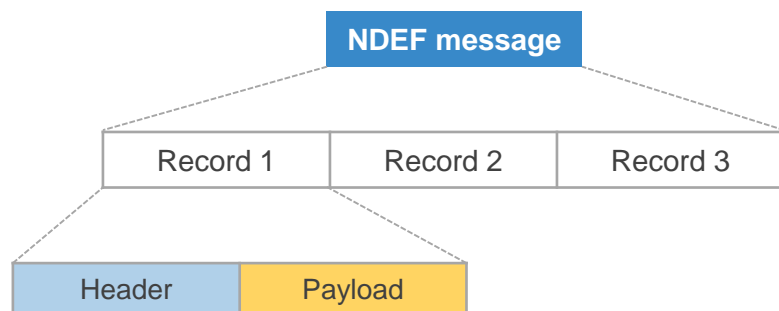


点对点有源 通信模式



通信数据格式

NDEF – 建立数据交换



Payload example

- NFC Forum Well-Known Type [NFC RTD]
 - 0x01 : http://www.
 - 0x02 : https://www.
 - 0x05 : tel:
 - 0x06 : mailto:
- Internet media-type (MIME) defined in RFC 2046
 - Image/jpeg, text/html

☞ NDEF NFC设备和标签基础信息交换格式

- NDEF 标签存储器数据结构的抽象，不同类型标签存储结构不同
- NDEF P2P模式下，一个或多个记录数据交换结构
- 记录类型定义容许合适的控制NDEF装载内容。

NFC 产品系列

Category

Key features

Technical features

Position

Markets & Benefits

Demo board

双界面NFC标签解决方案

NXP的双界面NFC标签包含NFC Forum定义的RF 接口, EEPROM 存储器, 电磁场侦测功能 (NTAG F) 或者带I²C 接口具有电磁场侦测功能 (NTAG I²C).



NFC 前端解决方案

NXP前端可以无缝使用NFC Reader Library, 是系统中加入NFC功能最灵活的一种方式



NFC 控制器解决方案

NXP NFC控制其解决方案具有更高的整合, 包含NFC前端和先进的32位的为控制器.

可选项, 内置firmware, 便于使用的标准化接口, 或者完全开放的客户可内置更多应用的可编程为控制器

Integrated Firmware



Customizable Firmware



PN7150 & NTagI2C 介绍



PN7150 是各种应用中快速集成NFC技术的理想选择

- 配对
 - Bluetooth, Wi-Fi, ZigBee
 - 家电自动化匹配
- 个人化
 - 个人化您的设备, 童锁控制
- 支付
 - 实现各种内容提供商的VOD点播
- 逻辑准入控制
 - 给授权个人准入
- 客户接口
 - 通过智能手机配置
 - 数据传输和产品的注册
- 维护管理
 - 故障诊断云协助
 - 固件更新
- 认证
 - 墨水, 电池, 耗材的原厂检测

Set top box/Smart TV



Printer



Appliances



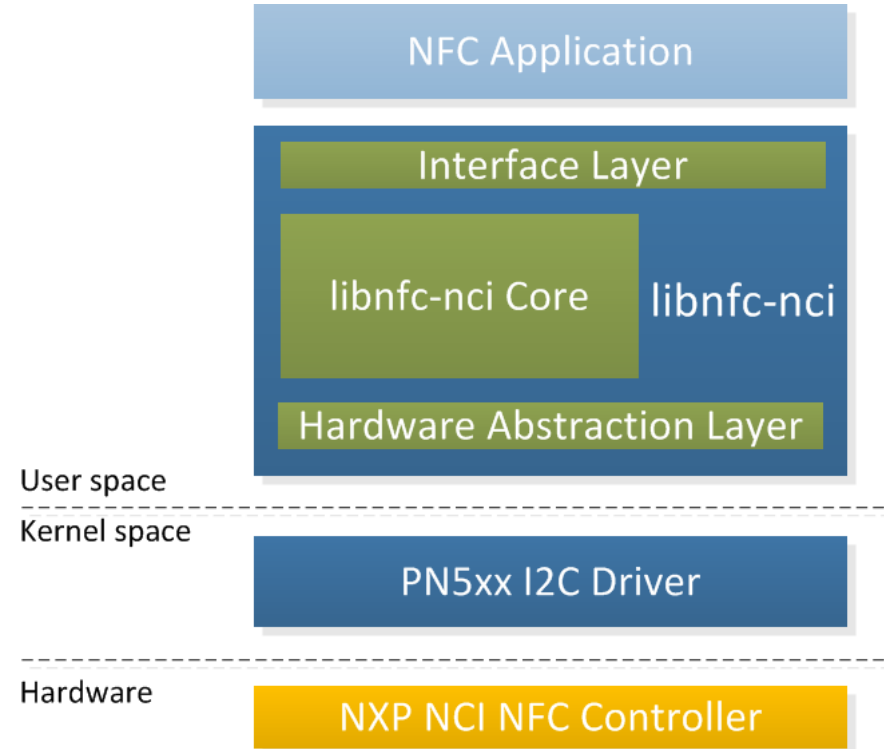
IoT home gateway



PN7150 – 高性能全NFC最好的即插即用方案



Linux NFC 架构一览

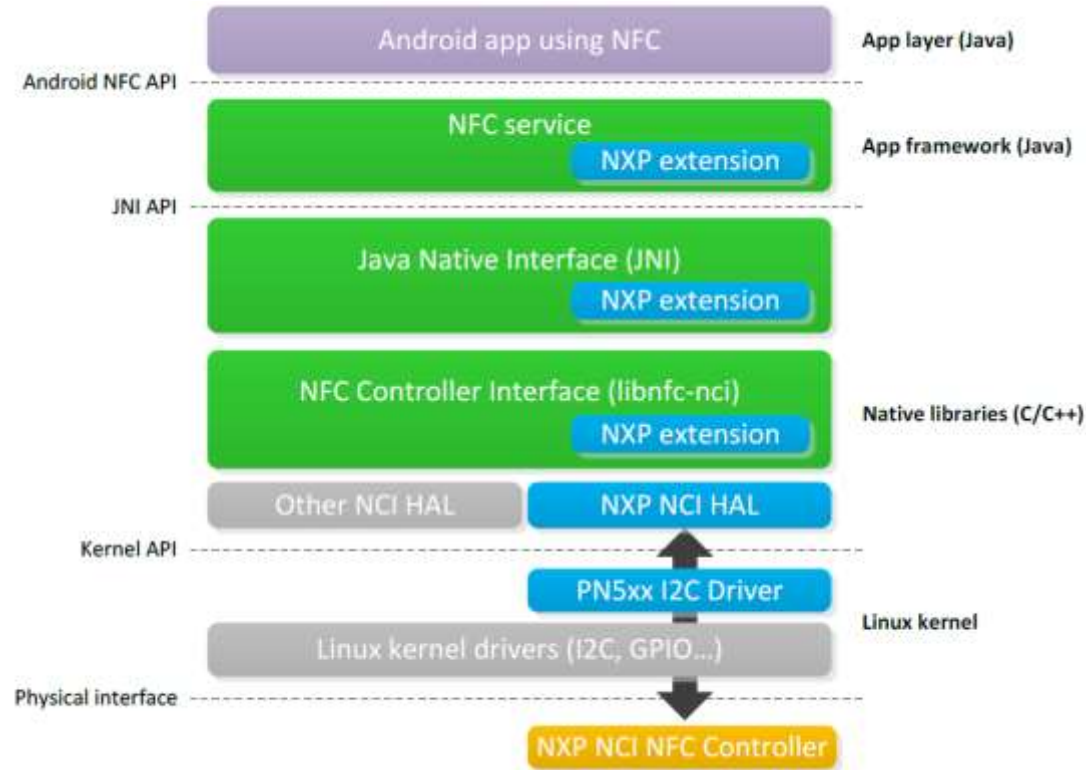


- The whole stack will be available on GitHub for Product Launch

https://github.com/NXPnfcLinux/linux_libnfc-nci

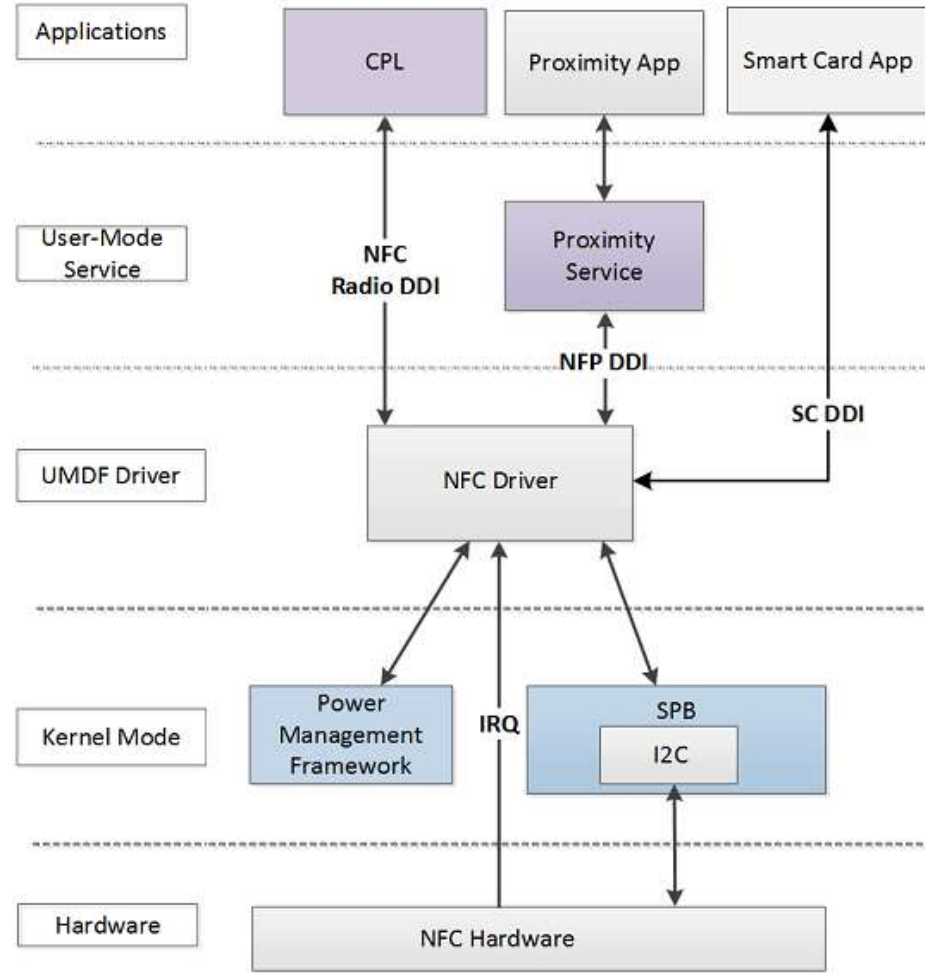


Android NFC 架构

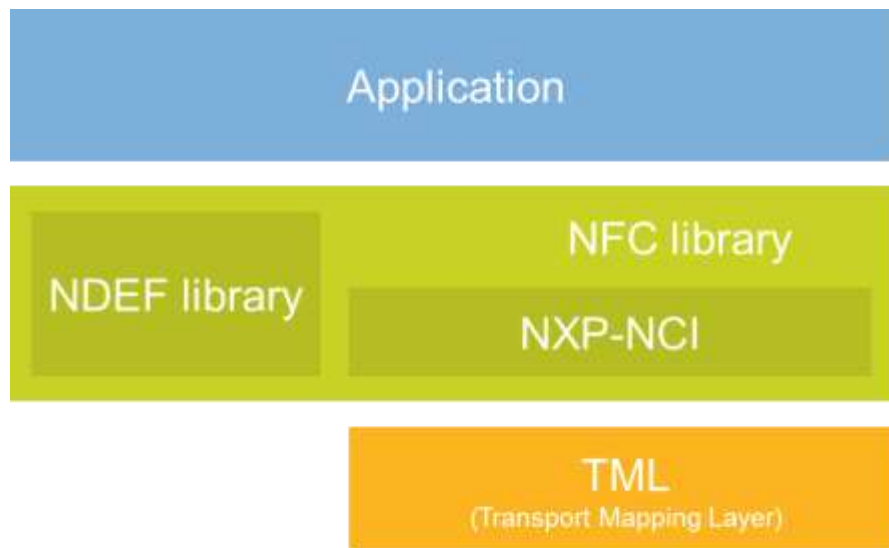


- **NFC service:** API within the Android framework that provides access to the NFC functionality.
- **JNI:** Glue code between Java classes and Native classes (written in C/ C++)
- **Libnfc-nci:** Native library providing NFC functionality for which extension is added to support NXP proprietary features
- **NXP NCI HAL:** NXP hardware specific implementation supporting full capabilities
- **PN5xx_I2C driver:** kernel module allowing to access NXP NCI based NFC Controller hardware resource.

Windows NFC 架构



NuRTOS/RTOS 示例



{NXP-NCI} module offers high level NFC API:
Connection and configuration of the NFC controller

- Start of the NFC discovery
- Wait for NFC discovery
- Process the NFC discovery

{NDEF library} module is composed of independent sub-module:

- ✓ {RW_NDEF} implements NDEF extraction from NFC Forum tags (all 4 NFC Forum defined tag types)
- ✓ {P2P_NDEF} implements NDEF data exchange with P2P device (over NFC Forum LLCP and SNEP protocols)
- ✓ {T4T_NDEF_emu} implements NDEF message exposure through card emulation (NFC Forum Type 4 Tag protocol)

{TML} module brings HW abstraction to NFC library (abstract how the connection to NFC controller IC is managed).

NTAG I²C *plus* – 产品技术特性

特征

- 内置50pF 谐振电容
- 888 或1,912 bytes 用于NDEF 信息格式(based on EEPROM)
- 32-bit 密码用于保护非授权的内存操作
- 可限制从I2C接口对内存的操作权限
- 64-byte SRAM 缓存
- 数据 Pass Through Mode
- 场中取电Energy harvesting输出
- 供电范围: 1.67 V to 3.6V
- 快速读写指令
- 支持ECC 原生检测
- 工作温度: -40C, +105C

主机接口

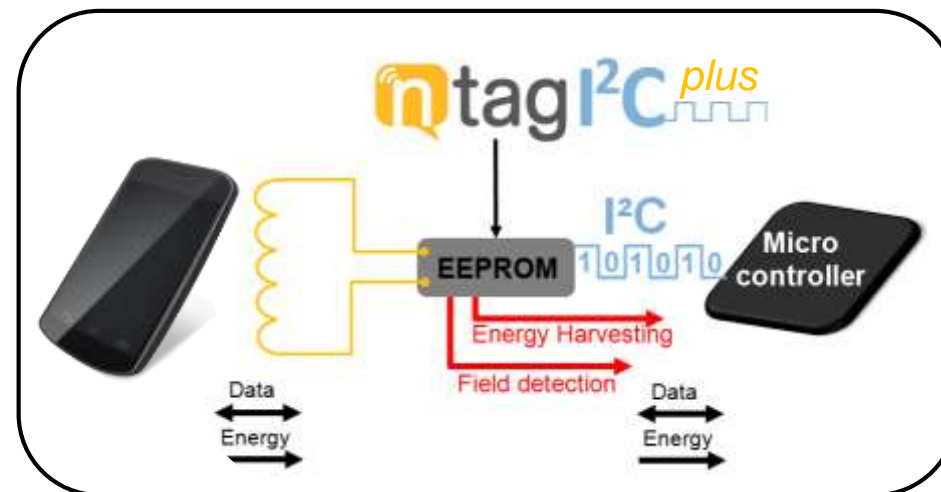
- I²C Slave 100/400 kbit/s
- 场监测引脚

支持的RF协议

- ISO/IEC 14443 Type A
- NFC Forum Type 2 Tag

封装

- XQFN8
- TSSOP8
- SO8

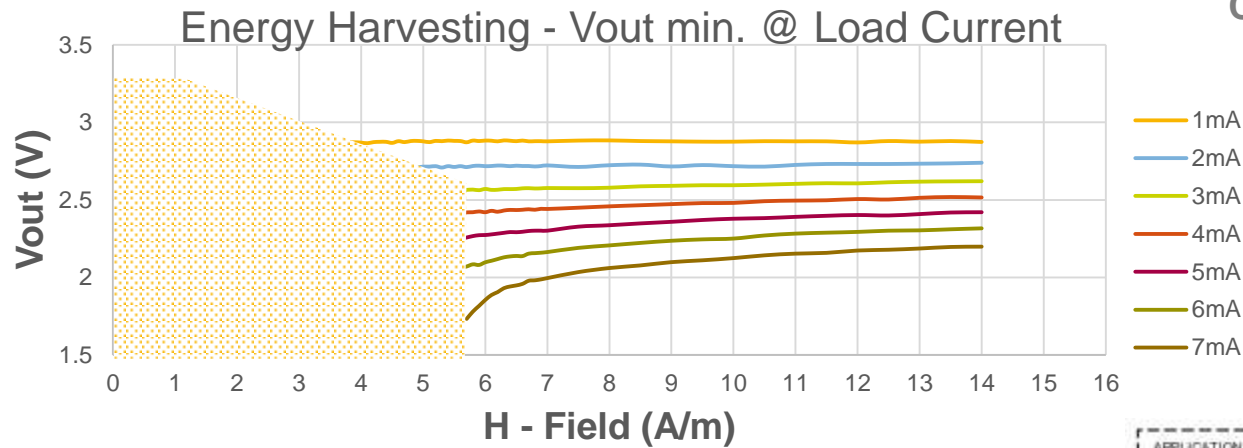


NTAG I²C *plus* – 最容易最低成本的 NFC 方案



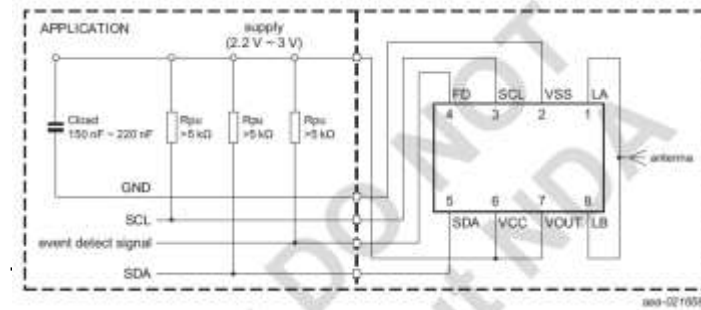
场中取电

Generate current and voltage at the Vout pin to power external devices like a MCU from the Energy harvested out of the RF field



Class 5 antenna with NFC reader
[2-3]V @ [1-7]mA

- Performance highly dependant on various parameters
 - Field strength
 - Antenna size & geometry (readers/tags)
 - Reader power (NFC phone vs NFC reader), also large spread
- Implementation recommendation available in the datasheet*

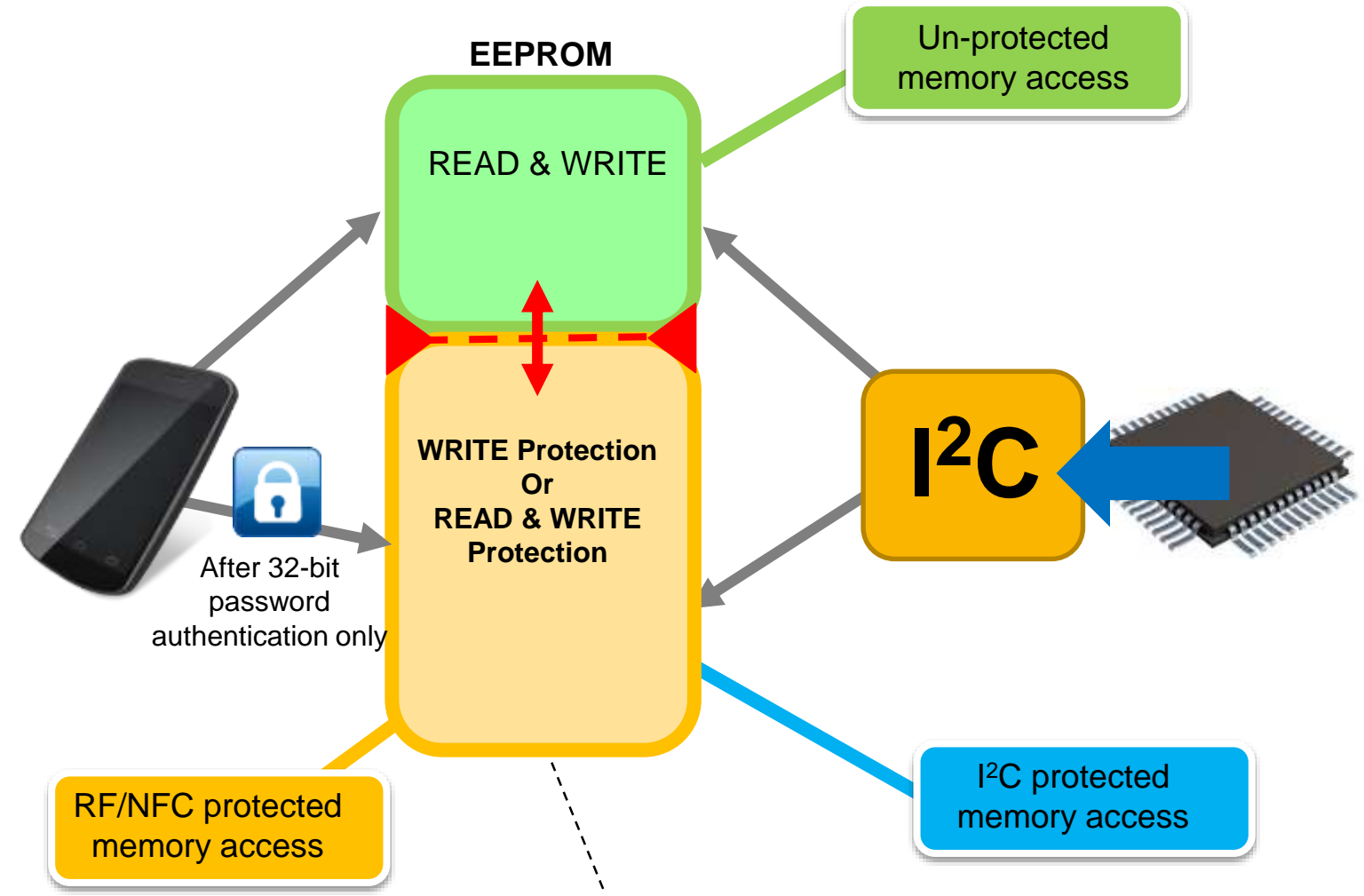


Pass-through 模式

- 基于中断信号,寄存器操作和读写SRAM缓存,可以在不中断系统通信进程的进行
 - 通过超快速存储器进行数据传输
 - 基于EEPROM, 重复使用和可靠性无忧
- 可通过联合使用FAST READ 和 FAST WRITE 指令完成快速全SRAM缓存读写
 - **FAST READ 指令**
 - 可同时读超过16 bytes
 - **FAST WRITE command**
 - 可一次写入全 SRAM 缓存 (64 Bytes)
- **标杆**
 - NTAG I²C plus 比现有的 NTAG I²C快四倍
 - ~ 4kBytes/s

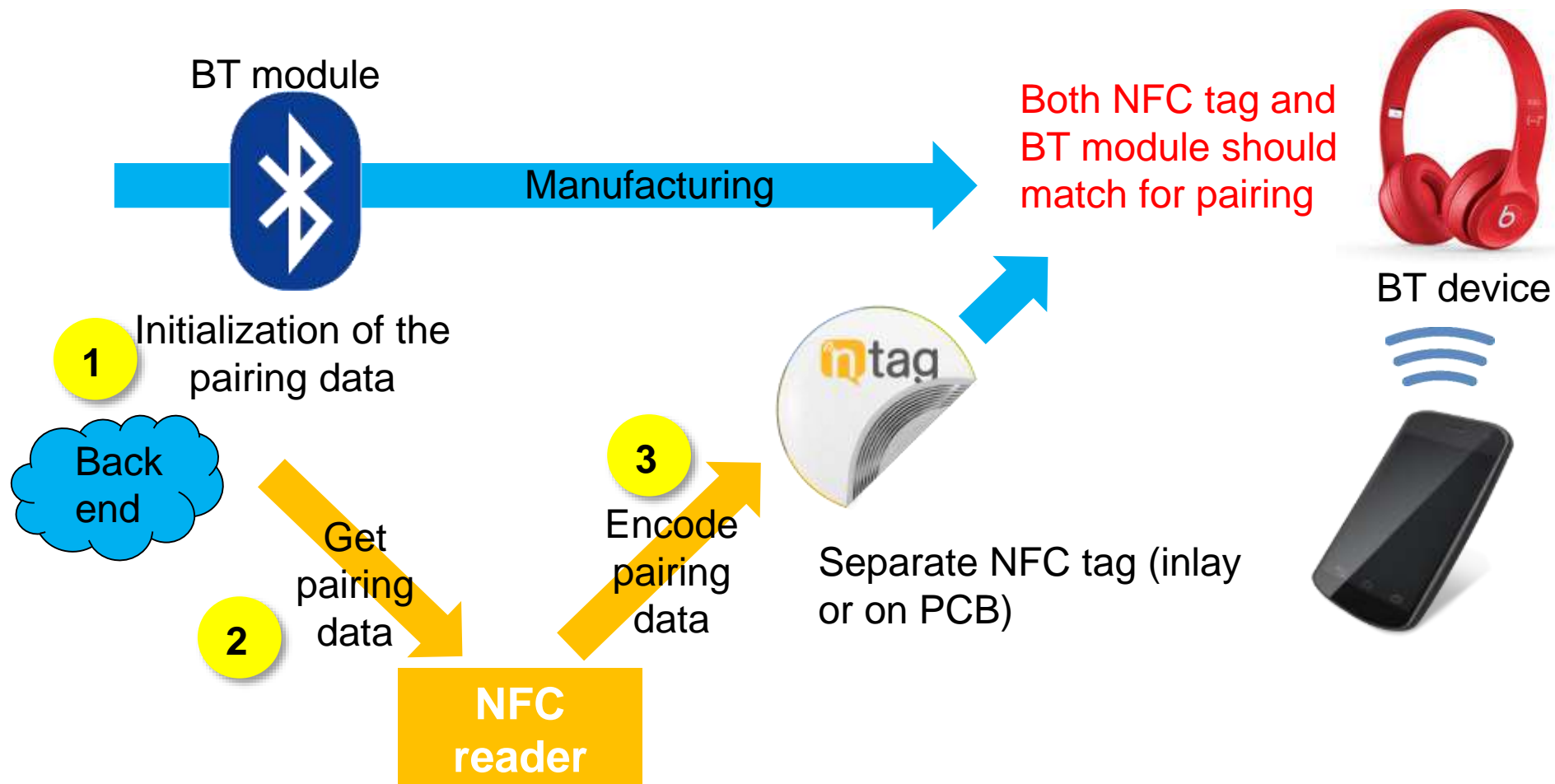
数据保护

RF and I²C access



Protected memory access rights can be set independently between I²C and RF

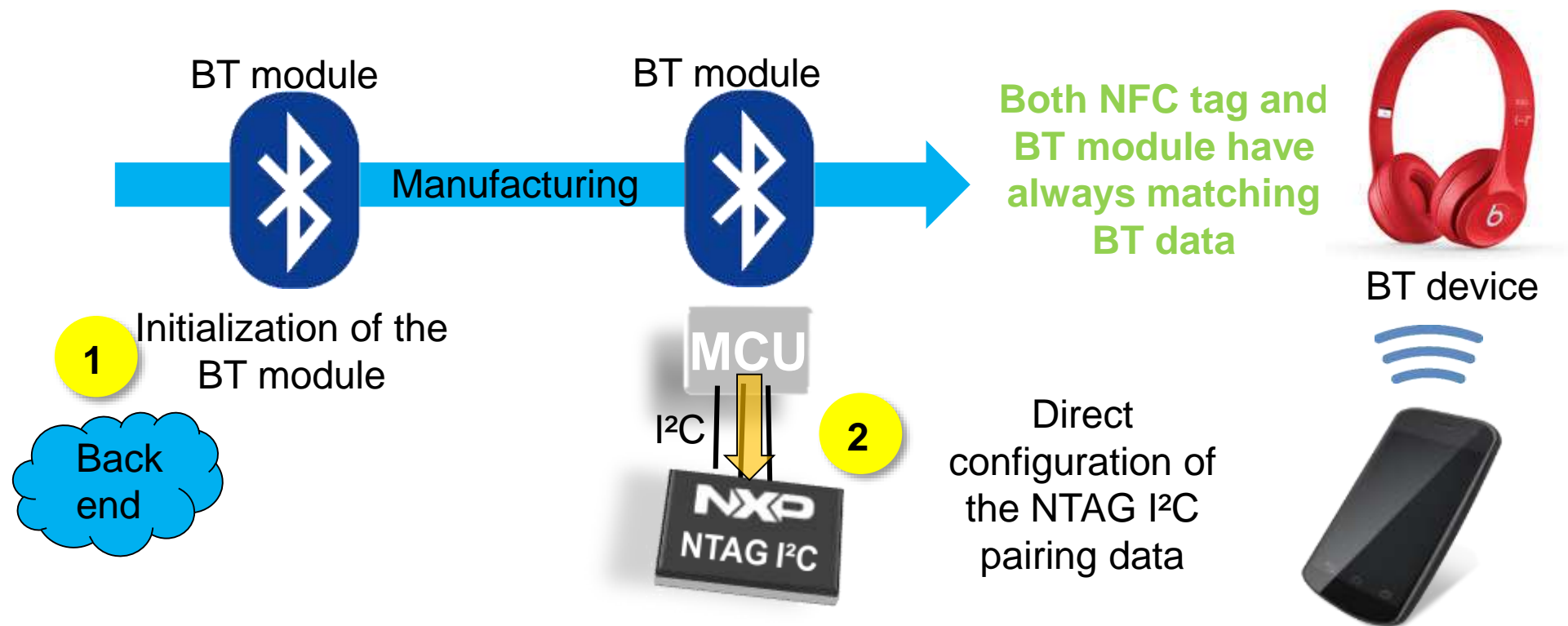
通过单独的NFC标签进行蓝牙配对



BT模块和 NFC 标签是完全不同的两个设备,之间无连接

- 要求通过NFC读写器对NFC标签进行初始化
- 双方配对信息要一致

Bluetooth 配对,通过NTAG I²C plus



NFC 接口和BT 模块的初始化更方便

- 例如上电boot up, 蓝牙模块可直接配置NTAG I²C plus
- NFC 标签初始化无读写设备要求
- 无配对信息不匹配风险

THANKS FOR ATTENDING!



NFC TECHNOLOGY HUB

Your source for everything NFC

www.nxp.com/nfc

- Latest news
- Latest product news
- Technical NFC Community
- Downloads
- And more to discover...

NFC Technology Hub

Near Field Communication is hot. In today's increasingly connected world, this simple, intuitive technology lets you interact securely with the world around you with a simple touch. NFC is available in hundreds of millions of smartphones, tablets, and other consumer electronics, with new devices arriving almost daily. We are convinced to see NFC everywhere very soon. This hub gives you technology insights as well as the latest news about NFC solutions from NXP.

With NFC being a specialized subset of RFID, also check out our dedicated [RFID technology page](#).

NFC News

[NFC pairing - More time to relax, entertain, and connect at home](#)

With just a tap, new purchases can perform service discovery, connect to the home network, or pair with other components, such as high-end speakers...

[Blog: the future of mobile transit](#)

With NFC (PN66T) in your phone and wearable, you can securely preload your fare into the phone with an instant online purchase...

[Press Release: NXP and Xiaomi Announce Mobile Payment Partnership](#)

[Read more about NFC >](#)

NFC Products

When adding NFC to a system, there are three options to choose from: [NFC frontends](#), which provide just the NFC function, [NFC controllers](#), which combine the NFC frontend with a microcontroller, and [NFC connected tag ICs](#), which are passive microchips used in smart NFC tags. We have released new products in all categories ushering in a new era in the evolution of NFC to bring intuitive proximity technology everywhere:

- [PN5180](#): High-power NFC frontend solution
- [PN7462](#): NFC Cortex-M0 microcontroller offering high performance and low-power consumption
- [NTAG FC plus](#): NFC Forum Type 2 Tag compliant IC with FC interface



NFC Commissioning for Smart Homes (02:11 min)

Design Resources

- [NFC Knowledge Base](#)
- [NFC Applications](#)
- Documentation
 - [NFC Everywhere: Controller, frontend, and connected-tag solutions for the next generation of NFC applications \(Brochure\)](#)
 - [NFC for embedded applications: Your critical link for the Internet of Things \(Brochure\)](#)
 - [Loader Service: The Tipping Point for Secure NFC Payments \(Whitepaper\)](#)
 - [What NFC means for smart factories, intelligent supply chains, and Industry 4.0 \(Whitepaper\)](#)
 - [NFC Product portfolio](#)

Featured Videos



History of NFC

In 2002, NXP and

NFC Support

[NFC Community](#)





SECURE CONNECTIONS
FOR A SMARTER WORLD

ATTRIBUTION STATEMENT

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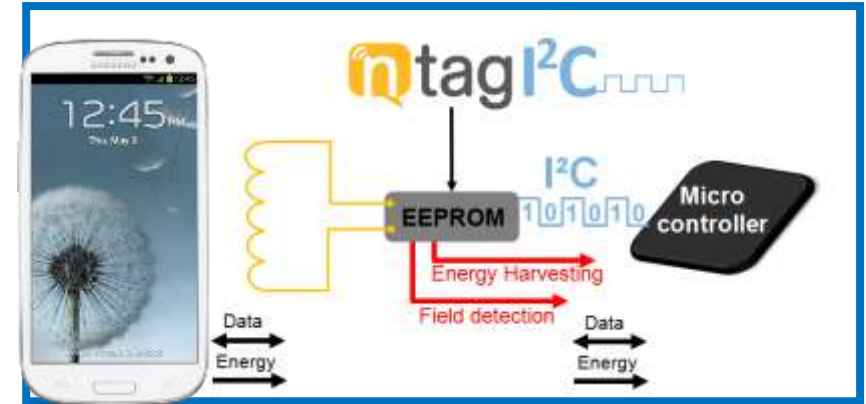


CONNECTED TAGS



NTAG I²C Plus Features

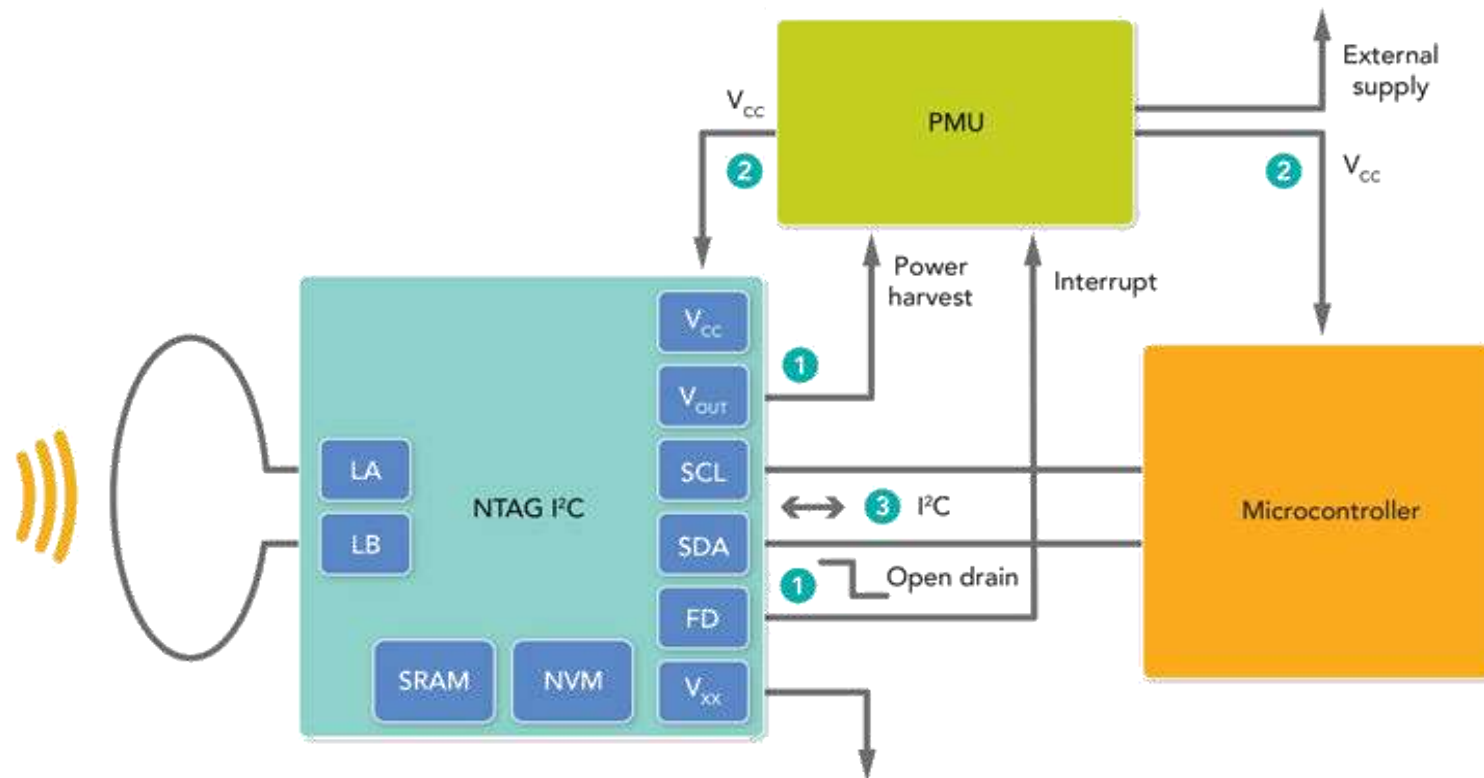
- NFC Forum Type 2 Tag (will be possible to certify)
- Dual interface
 - NFC & I²C (100 & 400 kHz) interface
 - **50 pF input capacitance**
- Either 888 or 1912 Byte EEPROM
- Energy harvesting functionality to power external device
- PIN to PIN outlines & fully backward compatible



What's NEW?

- **Pass Through Mode performance** increased by factor 4 in NFC to I²C with FAST_WRITE command to SRAM
- **Authentication:** Originality signature based on ECDSA (compatible with the NTAG 21x(F) family)
- **Access protection:** Optional 32-bit password on the full EEPROM and the SRAM buffer
- **SO8 package** & XQFN8 package (1.6 x 1.6 x 0.5 mm) & TSSOP8
- **Increased Compatibility** with legacy NFC devices (SRAM and CONFIG on sector 0)

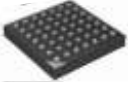
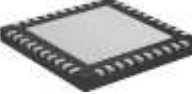
NFC Commissioning Solution



- For power management, the whole system may be powered up upon Field Detection
- FD is asserted low when the field is detected; PMU receives interrupt, switches V_{CC} on NTAG and μ C; μ C activates I²C
- Alternatively, V_{OUT} (harvested energy) may be used for low power devices as source of power.

PN7150 vs. PN7120



RF driver supply voltage	2.7V or 3.3 V	2.7V... 4.75V	More output power to work with smaller antenna or better performance
Card Emulation mode	NFC forum T4T - ISO/IEC A&B	NFC forum T4T - ISO/IEC A&B NFC forum T3T - FeliCa	Enable FeliCa use cases (Japan, HK, Singapore)
Package	VFBGA49 	HVQFN40 	Decrease PCB manufacturing cost (e.g. no microvias)
Load Modulation concept	Passive Load Modulation	Active Load Modulation	Allow decreasing antenna size with same RF performance in Card Emulation and passive Target modes



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