NXP Smart Washing Machine Solution
恩智浦智能洗衣机方案

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- NXP & Major Home Appliances

- Home Automation Market

- Generic Smart Home Architecture

- Home Appliances

- Smart WM vision

- Functions and technologies

NXP & Major Home Appliances

- ▶ Electronics are increasingly enabling key differentiators in the appliances industry

- ▶ NXP's mixed signal technology portfolio matches very well with the (future) needs of the appliance industry

NXP

- ▶ Combines technologies from different business units to create innovative solutions for customers

- ▶ Partners with leading customers to create new solutions

- ▶ Invests in application know-how

- ▶ Supports the robust quality and long life cycles that appliance makers need to be competitive

NXP Home Appliance Capability

User Interface

- Dedicated Cortex-M0 MCU
- Capacitive touch
- TFT driving with Cortex-M3/M4
- RF remote control
- NFC based programming
- Display drivers, RTC, LED drivers
- Mux/Demux, ESD protection

System Management

- Dedicated Cortex-M0 MCU
- TRIACS high/low current
- Smart sensors
- I2C / UART

Smart Appliance

- 802.15.4 / Zigbee, <GHz ISM, PLC
- AC Power monitoring
- Fabric & detergent detection (RFID)
- NFC based maintenance
- Secure device identity

Moto Control

- TRIACS high current
- Evolving MCU portfolio

Power Supply

- TEA 17xx based SMPS solutions, PFC
- Mega Schottky, BISS, TVS/ESD, HV, …
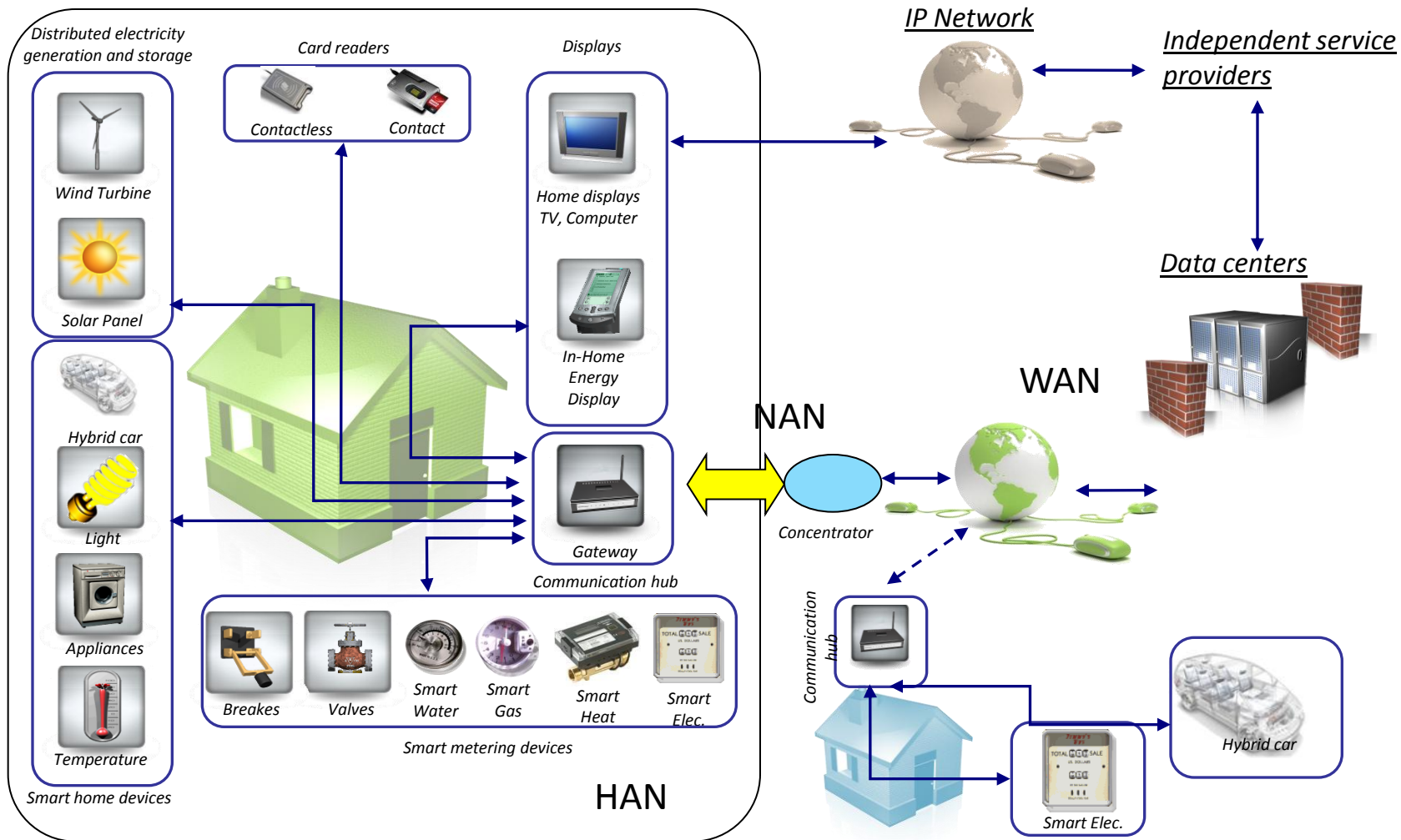
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Home Automation Market

Market drivers

‣ Rising energy prices

‣ Smart grid initiatives

‣ Government green regulations

‣ Consumer convenience

Technology enablers

‣ Low power affordable wireless networking

‣ Low power affordable sensors
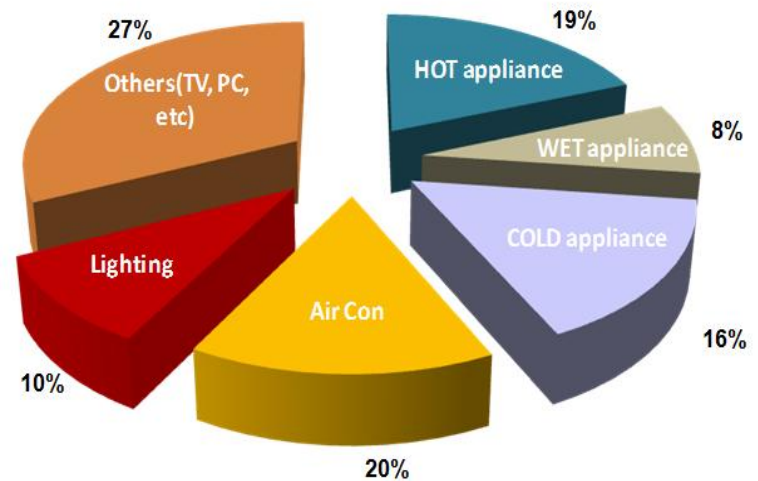
‣ Smart phone/tablets offer intuitive user interface

Generic smart home architecture

Smart appliances

Average home power profile

- ▸ Account for more than 50% of the energy consumption in the home

- ▸ Home appliances are key in any home automation concept

Smart appliance customer benefits

Technologies / Benefits	Smart grid ready	Power monitoring	RFID detection	NFC connect	Power supply	Advanced Motor Control	Smart sensors	RF Remote Control
Green environment	✔	✔	✔		✔	✔	✔	
Cost	✔	✔	✔	✔		✔		✔
User convenience	✔	✔	✔	✔			✔	✔

NXP Smart Washing Machine Demonstrator

Wireless Communication

AC Power Metering

Power Supply

NFC based maintenance

Fabric & Detergent Detection

32-bit ARM MCU for graphic U/I & system mgt

**32-bit ARM MCU & triacs for motor and load control**

Power Supply

Customer benefits

▸ Low standby power

▸ High efficiency

▸ Quick wake-up from stand-by to full operational mode
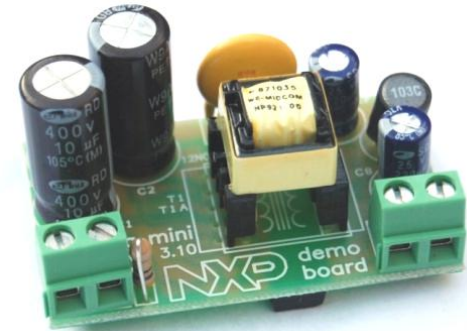
NXP solution

▸ TEA172x with integrated MOSFET

▸ Rectifiers & diodes

▸ Fly-back and Buck/boost topologies available

▸ <10mW standby power on circuit level

▸ Efficiency exceeding EnergyStar and Ecodesign

TEA1721 typical no-load power consumption (demo board optimized for 3W)
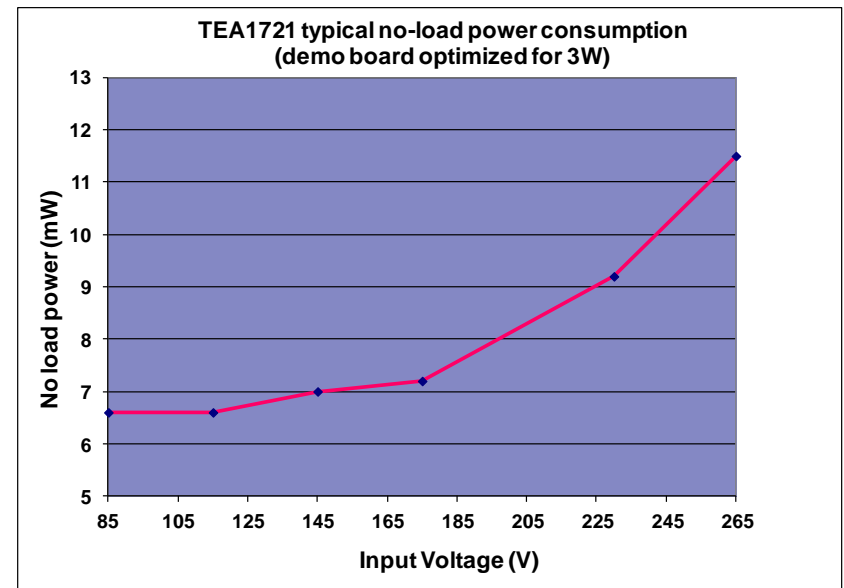
NFC Based Maintenance

Customer benefits
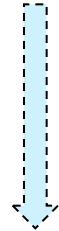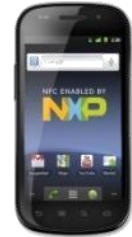
▸ Connectivity with NFC enabled phone

▸ Read/change machine status wirelessly

▸ App communicates with service center

NXP solution

▸ CLRC663 : NFC & RFID single chip solution

▸ Compact NFC stack

▸ NFC stack running on system controller (LPC1200)

Fabric and Detergent Recognition

Customer benefits

▸ Read fabric type/color of tagged clothing

▸ Read detergent characteristics

▸ Optimize washing program

▸ Avoid mixing white & dark laundry

▸ Reduce detergent/water usage

NXP solution

▸ CLRC663 : NFC & RFID single chip solution

▸ Compact RFID stack

▸ RFID stack running on existing system controller (LPC1200)

▸ Innovative antenna design for reliable tag detection

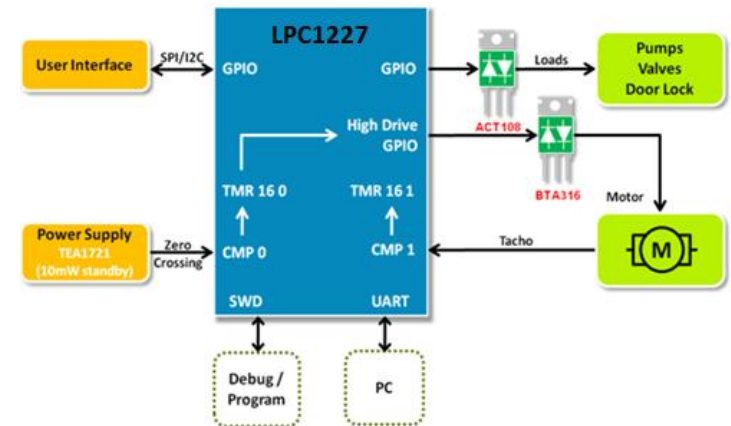▸ RFID tags integrated into clothing buttons

32 bit U/I & System Management

Customer benefits

▸ Handle complex washing programs

▸ One MCU handling system mgt, U/I, motor & load control

NXP solution

▸ Low gate count ARM Cortex-M0, LPC1227

▸ <1% Internal RC accuracy

▸ Up to 50% better code density

▸ Byte writable flash for data storage

AC power metering

Customer benefits

▸ Consumer energy awareness

▸ Remote diagnostics

▸ Cost effective AC power measurement

▸ No need to write or configure software

NXP solution

▸ AC power measurement implemented on host controller (LPC1227)

▸ API interface to appliance software

▸ Alternative : EM773 dedicated Energy Metering IC measuring 12 power quality parameters (power factor, blind power, power factor, …)

Energy Day = Wattage 1,000 w/kW × Hours Day × Number of Days
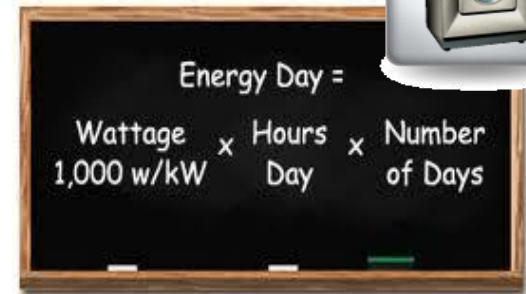
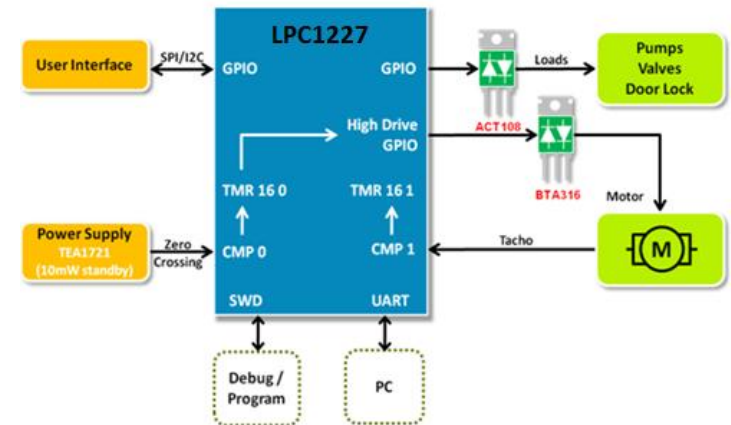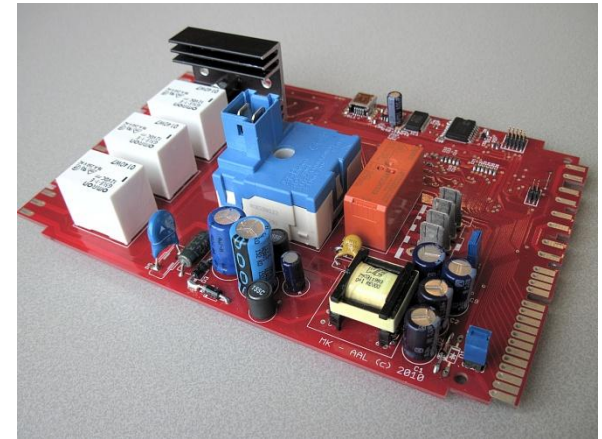EM773: 2010 EDN Innovation Award

32 bit motor and load control

Customer benefits

▸ Reliable control

▸ One MCU handling system mgt, U/I, motor & load control

NXP solution

▸ ROM division library in LPC1227

▸ High current GPIO

▸ IEC60730 safety compliant

▸ BTA316/ACT108 triacs for motor/load control

▸ High noise immunity triacs

Wireless communication

Customer benefits

‣ Wireless communication with smart meter / energy gateway

‣ Ultra low power

‣ FCC/ETS certified modules

‣ Choice of protocol stacks available

‣ Free open source based toolchain with Eclipse IDE

NXP solution

‣ Single-chip IEEE802.15.4, 2.4 GHz Radio and 32-bit MCU

‣ Range of software stacks for customers to choose from:

- ZigBee PRO Smart Energy and Home Automation

- JenNet – IP IPv6 based protocol

- RF4CE for remote controls

Additional Features in Development

RF Remote Control

Advanced user interface

Secure device identity
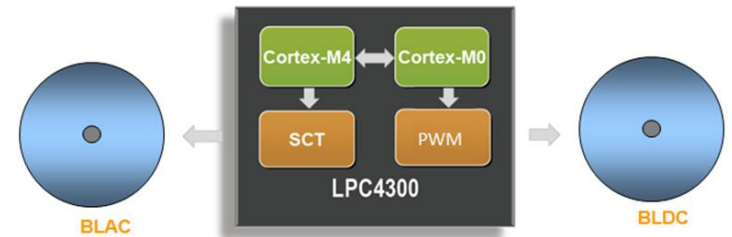
Advanced motor control

Smart sensors

Advanced motor control

Customer benefits

▸ Reduction of power consumption

▸ Quiet operation

NXP solution

▸ First generation "Smart" Triacs with embedded protection

▸ Low cost Cortex-M3/M4 for drum rotation control

▸ Cortex-M4 for driving Motor & digital PFC

▸ PFC diode portfolio for >95% efficiency

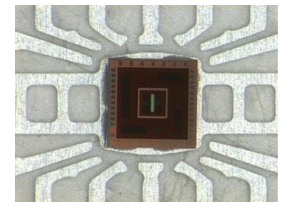# Advanced sensors

Customer benefits

- Low power
- Multiple sensors on one die
- Easy to integrate with other semis

NXP solution

- NXP developing low power CMOS sensors
- Integration of Light & Relative Humidity & Temp. on one die
- Competitive measurement accuracy

Advanced user interface

Customer benefits

▸ Intuitive user interface

▸ IPod-like look and feel

▸ Reduced standby power

NXP solution

▸ Broad MCU portfolio

- Cortex-M0 for driving LEDs and Seg./Graphic display

- High performing M3 and M4 for TFT driving

- Industry's fastest flash

- Free professional Graphical Library (Segger)

▸ Low current cap touch IC and LDC drivers
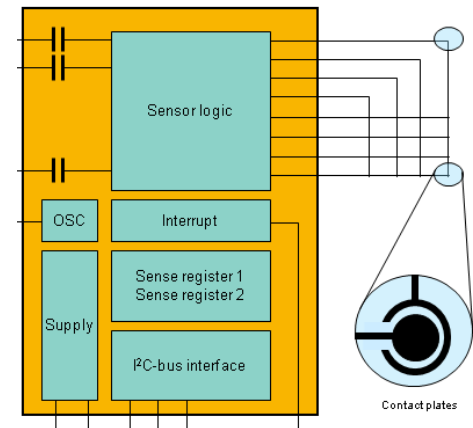
End-to-end smart grid security
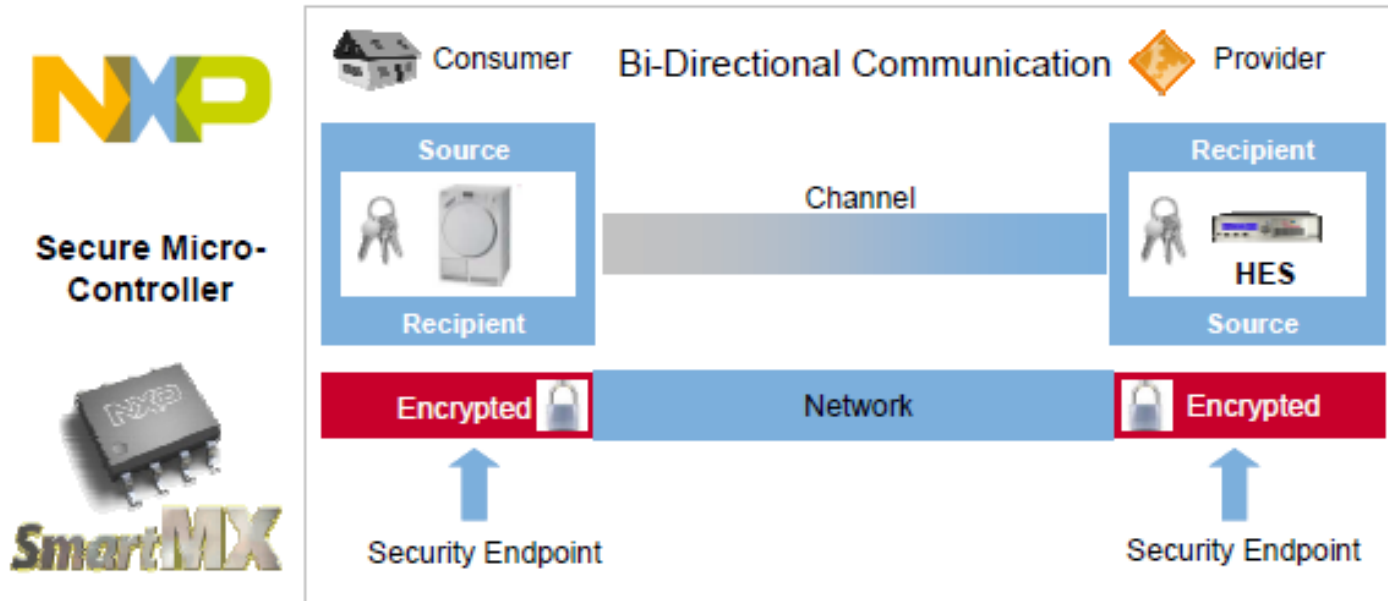
▸ NXP SmartMX™ ICs for authentication of smart grid components to:

   – secure data

   – preserve privacy

   – prevent counterfeiting and energy theft

RF remote control

Customer benefits

▶ Wireless bidirectional link to HVAC

▶ Monitors functional parameters (air filter change, ...)

▶ Saves and displays energy consumption over specific time

NXP Solution

▶ One stop solution supplier (Wireless / LCD driver /Touch IC, software)

▶ Extended battery life time, 30-35% less current

▶ Free protocol stack license

RF4CE
JenNet- IP
Zigbee Pro

Wireless communication with Zigbee

Customer benefits

▸ Wireless communication with smart meter / energy gateway / remote controller

▸ Ultra low power

▸ FCC/ETS certified modules

▸ Choice of protocol stacks available

▸ Free open source

NXP solution

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▸ Range of software stacks for customers to choose from:

- • ZigBee PRO Smart Energy and Home Automation
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RF4CE

JenNet- IP

Zigbee Pro