Solutions for NFC / RFID Tags and Readers

ST25
Simply
More Connected
Microcontrollers & Digital ICs Group
(MDG) Product Lines

**General Purpose Microcontrollers**
- STM32 – 32-bit MCUs
- Ultra-low-power / High performance
- Broad choice of peripherals
- Broadest portfolio
- 10 years longevity for industrial applications

**Secure Microcontrollers**
- Mobile Security (SIM, eSIM, NFC ctrl and e-SE)
- Automotive grade Secure MCUs
- Banking, ID and transport
- Authentication for secure IoT & anti-counterfeiting
- Turnkey solutions including certified HW+SW

**Serial EEPROM, NFC/RFID Tags & Readers**
- High-performance & high-endurance EEPROM
- NFC / RFID Tags, Dynamic Tags and Readers
- Advanced packaging options → Wafer Level Chip Scale Package (WLCSP)
- Automotive grade

**Aerospace, defense and mmWave Communication**
- RF mmWave Connectivity: SPARCLink 60GHz Transceiver (ST60)
- Satellite Constellation: Galileo satellite & user terminals and Space & Defense ASICs
MDG Group at a Glance

Key Financial Data by Sub-Group

Group 2018 Revenue

$2.94B
Microcontrollers & Digital ICs Group

$2.29B
MMS

$0.65B
Digital

FY18 vs FY17 Growth

+11%
MMS

+11%
MDG

+11%
Digital

MMS
Microcontrollers & Memories

Digital
Digital and Mixed ASICs, Aerospace, Defense and mmW Communication

mmW = millimeter Wave
Microcontrollers & Digital Group

2018 Revenues Split

- ~ 70% Revenues with Microcontrollers
- ~ 20% Revenues with Digital products
- ~ 10% Revenues with EEPROM memories

(*) Excluding automotive MCUs
Source: IHS Markit

Three Year Target

- Leadership on Embedded Processing (*)
- Migration of Digital competences to Industrial (MPU/AI) & RF mmW, capitalizing on ST differentiated technologies & IP
- Consolidate leadership in EEPROM Memories

(*) Excluding automotive MCUs
Source: IHS Markit
MMY Product Line at a Glance

**Standard EEPROM**
-40 to +85°C Industrial
-40 to +105°C Industrial-Plus
Up to 2Mbits, also in Ultrathin WLCSP

**Automotive EEPROM**
-40 to +125°C AEC-Q100 grade 1
-40 to +145°C AEC-Q100 grade 0
Up to 2Mbits, SO8N, TSSOP8 and FPN8

**NFC Tags and Readers**
NFC / RFID Tags
Dynamic NFC Tags
NFC / RFID Readers
UHF Readers

**Nb.1 WW EEPROM supplier with more than 45% market share**
Simply more connected with NFC / RFID Tags and Readers
NFC: A World of Opportunities

**CONNECTED DEVICES**

50 billion by 2020
Cisco estimation

A massive increase with ~ 15 – 25% annual growth

**NFC ENABLED DEVICES**

2.2 billion by 2020
IHS estimation

“Rich UI” devices will be dramatically outnumbered by “thing - headless” devices

**NFC MARKET VALUE**

400 $ million by 2020
Internal estimation (passive tags / dynamic tags / readers)

NFC the simplest way to give any “thing” a User Interface and much more smart functionalities
# RFID Technologies at a Glance

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<th>Coupling mode</th>
<th>LF</th>
<th>HF</th>
<th>UHF</th>
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<tr>
<td>Operating frequency</td>
<td>125kHz – 134kHz</td>
<td>13.56MHz</td>
<td>860MHz – 960MHz</td>
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<td>Antenna</td>
<td>Coil</td>
<td>Coil</td>
<td>Dipole</td>
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<td>Max operating distance</td>
<td>up to 1m</td>
<td>Vicinity: up to 1m</td>
<td>~10m</td>
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<td>Regulation</td>
<td>Worldwide harmonized</td>
<td>Worldwide harmonized</td>
<td>Different regulations per country</td>
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<td>Standards</td>
<td>ISO14223</td>
<td>ISO14443 A/B</td>
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<td>EPC Class 1 Gen 2</td>
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<td>Environmental influences</td>
<td>Small influence on operating distance</td>
<td>Small influence on operating distance</td>
<td>Influence on operating distance by reflection and absorption (metal and liquids)</td>
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<td>Authentication</td>
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<td>ST solutions</td>
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<td></td>
<td>X</td>
</tr>
</tbody>
</table>
NFC Technology at a Glance

An interactive technology enabling engagement with IoT devices

- Near Field Communication, a short range wireless technology
  - Operating at 13.56MHz
  - Based on the RFID HF standard (ISO14443 & ISO15693)
- Interactive and zero power, enabling convenient connection to the Internet of Things
  → NFC-enabled mobile phone can engage with items by a simple tap
- NFC is developed by the NFC Forum
  - Interoperability between devices
  - Standardized use cases (web link, Bluetooth handover,…)
- Fast growing deployment in Mobile phone
  - In 2018, two in three phones to come with NFC
  - NFC is used for Mobile payment (EMVco) like ApplePay
  - Apple added in 2017 support of NFC reader mode from iOS11 onward
  - Apple Keynote WWDC 2019: iOS13 is announced, with support for NFC writer & reader modes
NFC is unique in the wireless spectrum: Short distance, Low data-rate & Zero power for applications
NFC is complementary to Wi-Fi and Bluetooth technologies: Tap & Pair for convenient pairing use case
NFC Forum Standards

NFC specification ➔ Upper layer SW

RFID HF ISO standards ➔ HW / SW protocol

NDEF (NFC Data Exchange Format)

NFC Forum Type 2 and Type 4

NFC Forum Type 5 *

ISO14443
Type A and Type B

« Short Range »
106kbps

ISO15693
« Long Range »
26kbps

(*) ISO15693 integrated in NFC Forum specifications in October 2015 as NFC Forum type 5 (aka type V)
Typical NFC / RFID Range

- ISO14443 (NFC Forum Type 2 & Type 4) is called « short range » standard while with higher RF speed
- ISO15693 (NFC Forum Type 5) is called « long range » standard
From Factory to Consumer
Bridging RFID and NFC

ISO 15693
1 meter few feet
NFC Type 5
ST25 Matching ST Strategy

- Wearable & Healthcare
- Gaming & Payment
- Connected Home
- Home Appliance & Automation
- Lighting & Metering
- Asset tracking
- Car access
- Car center console
Covering all NFC application needs and leveraging a rich ecosystem

www.st.com/nfc

ST is Member of NFC Forum, RAIN Alliance and ISO organizations as well as the CCC and WPC Alliances
Mobile Security Convergence

From diversified NFC & Security solutions to rationalized solutions

- eSIM
- SIM
- eSE
- TPM
- ST33

**ST33G1M2 SE (80nm) / ST33J2M0 SE (40nm)**
- 1.2MB / 2MB Flash
- Increased Performances
- EMVCo, CC EAL5+

- NFC
- ST21NFC

**ST21NFCD Controller (80nm)**
- Boosted for tiny & metal cover antenna
- Reduced BOM
- Low Power mode
- Card emulation, Reader & P2P

- ST54

**ST33G1M2 SE (80nm) / ST33J2M0 SE (40nm)**
- 1.2MB / 2MB Flash
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**ST21NFCD Controller (80nm)**
- Boosted for tiny & metal cover antenna
- Reduced BOM
- Low Power mode
- Card emulation, Reader & P2P

**ST54**
- High eSE performance
- Large Memories
- Mifare® & FeliCa®
- boostedNFC™
- EAL5+, EMVCo, MTPS

From diversified NFC & Security solutions to rationalized solutions
Wearable Convergence

From discrete to integrated payment, NFC, eSE, eSIM solutions

**ST33G480 SE (80nm)**
- 480KB Flash
- Increased Performances – 160pf
- EMVCo, CC EAL5+

**ST53G**
- All in one system in package
- boostedNFC™
- Easy integration
- Plug & Play payment solution STPay

**ST31**
- Passive payment and transport application

**ST31**
- ST3922 Booster

**ST21NFC**
- ST33 eSIM / eSE

**ST54**
- High eSE performance
- Large Memories
- Mifare® & FeliCa®
- boostedNFC™
- EAL5+, EMVCo, MTPS

**ST54**
- Active high-end multi-application (payment, eSIM, eSE, NFC)
ST25 Products Families

Tags

ST25T

13.56MHz

NFC phone / RFID Reader

Consumer engagement, Asset tracking, Ticketing, Gaming, Brand protection, Access control, …

www.st.com/st25t

Dynamic tags

STM32 microcontroller

I2C

ST25D

13.56MHz

NFC phone / RFID Reader

Industrial, Lighting, Consumer, Metering, Appliance, Healthcare, … (Fast Transfer Mode and SW upgrade)

www.st.com/st25d

Readers

STM32 microcontroller

SPI

ST25R

13.56MHz

NFC phone

POS & mPOS Terminals, Automotive, Access control, Gaming, …

www.st.com/st25r

or

or
ST25 Series Enriching Our Lives!

Main Applications

- Consumer Home Appliance
- Healthcare Gaming
- Brand recognition Accessory
- Asset Tracking
- Transport
- Industrial
- Smart Home Smart City
- Access control
- Automotive
- Point of sales
# Certification & Interoperability Status

<table>
<thead>
<tr>
<th>Tags</th>
<th>Dynamic Tags</th>
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</thead>
<tbody>
<tr>
<td>ST25TV</td>
<td>ST25DV-I2C</td>
</tr>
<tr>
<td>ST25TA</td>
<td>ST25DV-PWM</td>
</tr>
<tr>
<td>ST25TB</td>
<td>M24LR (*)</td>
</tr>
<tr>
<td></td>
<td>M24SR</td>
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</tbody>
</table>

- **NFC Forum**: Not for NFC applications (RFID, ticketing)
- **Memory Read/Write**: N/A
- **NDEF Read/Write**: N/A
- **Custom Commands**: N/A
- **Password Management**: N/A
- **TrustST25 Digital Signature**: N/A

(*) M24LR: 04E interoperable with iOS11 - 16E and 64E not for iOS. ST25DV16K or ST25DV64K as replacement product for iOS interoperability. To be clarified with iOS13.

(**) Chaining during write operations is not used by Smartphones.
Key Use Cases
URL Link “Tap & Get Web Page”

Direct access to a Web page

Native support with NFC phone (NDEF)

Open a web page

Built-in technology
Background tag reading

ST solutions

- Tag
- Dynamic Tag
“Tap & Get App”

Direct access to Google Play and Apple store to download an app

Native support with NFC phone (NDEF)

Built-in technology
Background tag reading

Link to Google Play
Link to Apple Store

ST solutions
- Tag
- Dynamic Tag
E-warranty Card & Customer Registration

Pre-program activation email in ST25 product

Native support with NFC phone (NDEF)

Activate Warranty

Built-in technology

Background tag reading

To: customer.service@st.com

Subject: warranty activation #627123A58-A

Dear customer service,

I would like to activate the warranty card for item serial number #627123A58-A and apply for the 2-year program.

ST solutions

- Tag
- Dynamic Tag
Wireless Pairing “Tap & Connect”

Easily pair your connected devices

Native support with NFC phone (NDEF)

Ease Bluetooth / Wi-Fi pairing by simple tap
Just wave your phone to pair

Plug & play technology
Built-in handover in Android & Windows

Multi-user management
Tap your phone to give or take control

Zero impact on power budget
zero power interface & and features field detect

Built-in technology

ST solutions
• Tag
• Dynamic Tag
Track & Trace, Consumer Engagement and Brand Protection based on Cloud management

- Branding and Consumer Engagement
- Product identification with enriched information
- Identity check using digital signature
- Tamper detect for open-close detection

ST solutions: Tag
Business Card (Vcard)

Tap & download the contact on your phone

Native support with NFC phone (NDEF)

New Contact

Built-in technology
Background tag reading

ST solutions

Tag
Contactless electronic ticketing

- Fast data transfer based on ISO14443
- Large and unique counting capability with anti-tearing feature
- Anti-collision mechanism
- Compatible with most popular contactless ticketing systems

ST solutions

- Tag
- HF Reader
Asset Tracking

Enhanced logistic operations

Add relevant information onto your NFC / RFID tag
Information will be protected by passwords

Up to date information
Up-date the electronic label whenever necessary

Combined benefits of RFID & NFC technologies

ST solutions

• Tag
• HF Reader
Parameter Setting

Save time on your production lines

From DIP switch / resistor to contactless setting
Get rid of manual operation

In the Box “programming”
Simple & flexible

Upload new setting to powered off devices
Personalize your boxed devices on the production belt

ST solutions

• Dynamic Tag
Maintenance & Service

Real-time communication and in application programming

- Fast Transfer Mode with 256 Byte buffer for data synchronization and Firmware update
- Manage your stock efficiently with easy reconfiguration of boxed products
- Convenient access to the embedded device for diagnostic and re-programming

ST solutions

• Dynamic Tag
Seamless user interface simplicity

Provide any electronic device with remote display
Use your NFC-enabled Smartphone or Tablet

Several native operation options
Enhanced with a suited App

Let any object become Smart with a Tap
Exploit Smartphone processing power

ST solutions

• Dynamic Tag
Energy Harvesting to power low power devices

Energy harvesting from NFC RF Field

- NFC connectivity
  - Enhanced with a suited App
- Up to 5mA with NFC reader
- ST one-stop-shop with low power MCU and sensors
  - with SmarTAG solution

ST solutions
  - Dynamic Tag
Convenient Data-logging

Data-log on the spot or off-line data access for consumer & industrial applications

Convenient access to your monitored data
Easy to do with a smartphone as display

Broad range of application
Logistics, Maintenance assistance, Consumer

Data accessible even when system is powered off
Tag acting as a “black box” tool

ST solutions

- Dynamic Tag
- HF Reader
Dynamic Tag Enabling Multiple Benefits
During the Entire Product Lifecycle

- Parameters setting in production
- Logistics / Asset tracking
- Wireless networks pairing
- Remote programming / FW upgrade
- Data download / Data-log
- Servicing & Maintenance
- Consumer engagement
Payment & Home Banking

Payment made easy and secure

- Payment & Home Banking
  - Full EMVCo POS and mobile POS (mPOS) for cashless transactions with minimal investment

- Enhanced user experience
  - Quicker payment processing
  - Add new services like loyalty cards

ST solutions

- • HF Reader
Car access and console personalization

NFC for car access and ignition
Convenient and secure access to the car
Distribution of keys online to your NFC smartphone

In-car personalization with secure pairing
Just sit in and the entire cockpit will fit the driver wish

NFC for car diagnostic
No physical connection required

ST solutions

• HF Reader
Connected Homes

Second screen & remote UI

Use your NFC smartphone to Tap & configure, while authentication feature let you safely access your online accounts, gaming, or social media.

Quick and secure pairing to any connected device. Tapping a TV will turn your Phone into a second screen.

ST solutions • Dynamic Tag • HF Reader
Enhance your gaming possibilities by using NFC

Figurines come to life, using NFC to connect to a gaming console

Player and figurine interaction without any external battery need

ST solutions
- Tag
- HF Reader
Access control made smart

Smart locks
NFC assisted lock configuration to grant temporary access rights (maintenance, friends…)

Hotel Access
with cards or NFC smartphones

ST solutions
• Tag
• HF Reader
Accessory Recognition

Brand recognition and parameters setting

NFC for accessory identification
Convenient and reliable brand identification

Automatic System configuration
Upon accessory type recognition

Brand Recognition
Ensure only branded accessory are used

ST solutions
- Tag
- Dynamic Tag
- HF Reader
UHF Reader for Logistics

Ideal for battery operated handheld devices

UHF solution
Suitable for Hand-held readers, stationary readers, Embedded readers and mobile UHF RFID readers

Dense Reader Mode
for Battery Handheld

Fast Moving Consumer Goods

ST solutions
• UHF Reader
ST25 Series Overview
ST25 Tags & Dynamic Tags DNA

**Standard Compliant**
- NFC Forum
- ISO14443A
- ISO14443B
- ISO15693

**Feature-rich**
- 13.56MHz
- I2C interface
- Energy Harvesting
- Fast Transfer Mode
- Digital Signature
- 20-bit counter

**Best-In-Class Memory**
- From 512-bit to 64-Kbit
- 1M erase-write cycles
- Up to 200 years retention
- 128-bit password

**High Volume & Quality**
- In-House manufacturing
- Leverage Automotive EEPROM quality
- Leverage Consumer EEPROM volume

Comprehensive Portfolio
ST25 Readers DNA

**Standard Compliant**

- NFC Forum
- ISO14443A/B
- ISO15693
- ISO18092
- ISO18000

**High performing HF Readers**

- 13.56 MHz
- Very High Bit Rate (6.8Mbit/s)
- Automatic Antenna Tuning
- High output power (1.4W)
- Low power wake-up modes
- Temperature -40°C to 125°C

**High performing UHF Readers**

- 840-960 MHz
- High Rx Sensitivity (-90dBm)
- Low noise Voltage Controlled Oscillator
- Dense Reader Mode filters
- Tag movement detection

**Certification**

- EMVCo
- PBOC
- Automotive AEC-Q100
- FCC
- CE mark

Comprehensive Portfolio
ST25 Products Families

Ticketing, Gaming, Medical, Brand protection, Access control, …
www.st.com/st25t

Industrial, Consumer, Metering, Appliance, …
www.st.com/st25d

POS & mPOS Terminals, Automotive, Access control, …
www.st.com/st25r
# ST25 NFC Portfolio

One-stop-shop for Tags and Readers

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<th>Dynamic Tags</th>
<th>HF Readers</th>
<th>UHF Readers</th>
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<td>M24SR</td>
<td>ST25R95</td>
<td>ST25RU3993</td>
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<td>ST25TB</td>
<td>M24LR</td>
<td>ST25R3911B</td>
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<td>ST25TV</td>
<td>ST25DV-I2C</td>
<td>ST25R3912</td>
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<td>ST25DV-PWM</td>
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<td>up to 53kbps</td>
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<td>6c &amp; b Gen2 Protocol</td>
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<td>Card Emulation</td>
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<td>EEPROM</td>
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<td>Reader / Writer</td>
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<td>4Kb-64Kb</td>
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<td>Reader / Writer</td>
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<td>64b counter</td>
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<td>Card Emulation</td>
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<tr>
<td>Lock</td>
<td>16b counter</td>
<td>Card Emulation</td>
<td>Card Emulation</td>
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<td>UID</td>
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<td>Reader / Writer</td>
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<td>1.7V-5.5V</td>
<td>400kHz</td>
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<tr>
<td>I2C</td>
<td>RF detect</td>
<td>Reader/Writer</td>
<td>Reader / Writer</td>
</tr>
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<td>Fast Xfer Mode</td>
<td>Reader/Writer</td>
<td>Reader / Writer</td>
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<tr>
<td>1MHz</td>
<td>488-31.25 kHz</td>
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<td>2.7V-5.5V</td>
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</tr>
<tr>
<td>PIC &amp; UART</td>
<td>2.4V-5.5V</td>
<td>Card Emulation</td>
<td>Card Emulation</td>
</tr>
<tr>
<td>2Mbps</td>
<td>1W – 1.4W</td>
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</tr>
<tr>
<td>SPI</td>
<td>SPI</td>
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<td>Card Emulation</td>
</tr>
<tr>
<td>6Mbps</td>
<td>2.4V-5.5V</td>
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</tr>
<tr>
<td>1MHz</td>
<td>1W</td>
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</tr>
<tr>
<td>1.8V-5.5V</td>
<td>2.4V-5.5V</td>
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<tr>
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<td>2.4V-5.5V</td>
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</tr>
<tr>
<td>0-20dBm</td>
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<tr>
<td>10Mbps</td>
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<td>0-20dBm</td>
<td>1.7W</td>
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</table>

*: same as former CR95HF / ST95HF
10-year Longevity Program

- For ST25 Tags & ST25DV Dynamic tags, the 10 years longevity commitment starts from the following dates:
  - ST25TA series, starting January 1st 2019
  - ST25TB series, starting January 1st 2019
  - ST25TV series, starting July 1st 2019
  - ST25DV-I2C series, starting January 1st 2019
  - ST25DV-PWM series, starting July 1st 2019

- For the rest of ST25 products, it will be managed case by case after contacting division.

- The 10 years longevity commitment includes the period of notification as set forth in the standard STMicroelectronics end-of-life notification policy (PTN).

- In case of significant volume decrease, technology or manufacturing changes, a switch to a comparable product, another technology or a different manufacturing facility could be decided by STMicroelectronics who will notify customers using the standard STMicroelectronics product/process change policy (PCN).