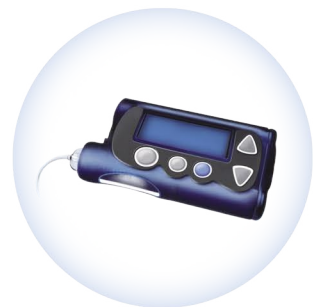
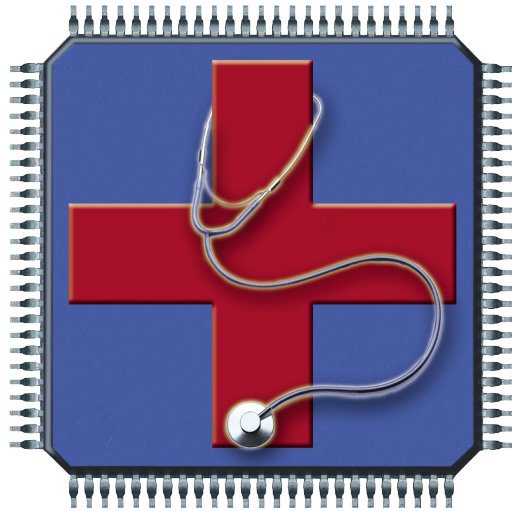


Healthcare

Electronic application solutions



Introduction

The Healthcare market is increasingly becoming a greater portion of the overall semiconductor market with significant growth expected worldwide.

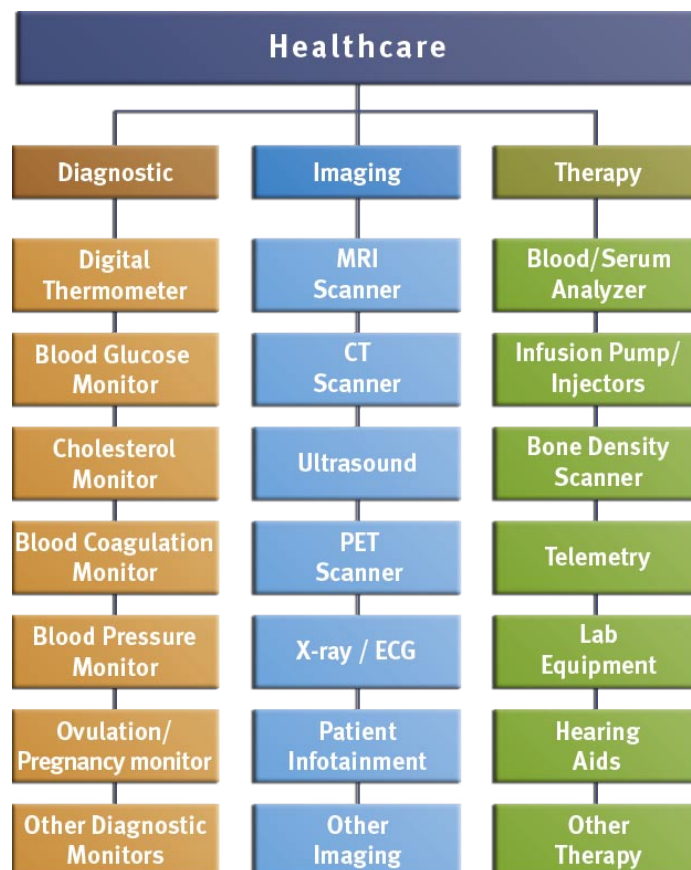
NEC ELECTRONICS recognises that within this market there are multiple applications and many different forces affecting development trends. Some are general trends such as the movement from post care to pre-care, others are legislative trends that have to be adhered too. However, the most important trend is the growing demands of the consumer. This is driving the requirement for more intelligent medical devices, which in turn are demanding the following features:

Performance	<ul style="list-style-type: none"> • Low Power Consumption • High Speed (MIPS)
Reliability	<ul style="list-style-type: none"> • Accurate Measurement • High Quality Grades
Enhancements	<ul style="list-style-type: none"> • Space Saving Packages • Human to Machine Interface (HMI)

As well as providing this within an extensive product range, NEC ELECTRONICS assists your time to market by utilizing our dedicated application team plus infrastructure of application notes, reference designs, software & demo tools.

Healthcare Applications

The key applications within the Healthcare market can be categorized as follows:



Application Requirements

NEC ELECTRONICS, as a solution's provider, offers an excellent mix of technologies:

- ✓ Microcontrollers (8-bit / 16-bit / 32-bit)
- ✓ TFT LCD (Mono/Colour)
- ✓ ASIC (Cell based/Gate Array/ARM)
- ✓ USB2.0
- ✓ MOSFET, Optocoupler & Commodity devices

Diagnostic Requirements

Performance

- Low power consumption for extended battery life
- High CPU performance for monitoring unit
- Flash technology – no volatile data storage for measured data recording
- Connectivity solutions for improving interfaces

Reliability

- High resolution and high speed A/D converters for accurate measurements
- Different quality grades to respond to qualification requirements

Enhancements

- Keypad interface to simplify human body data acquisition
- HMI to improve readability
- Small packages for portable devices



Imaging Requirements

Performance

- High luminance
- High definition
- High contrast

Reliability

- Long term support for Healthcare application requirements
- Wide operating range for intensive use

Enhancements

- Extensive choice of TFT LCDs from small to large sizes
- Monochrome and Color TFT LCD displays



Therapy Requirements

Performance

- High processing speeds for health monitoring applications
- Large memory range for demanding applications
- Abundance of peripherals to meet clinical requirements
- Connectivity solutions for improving communication interfaces

Reliability

- High quality grades for required qualifications
- High resolution A/D converter for accurate measurements

Enhancements

- Monochrome and Color TFT LCD display for monitoring equipment
- Glass LCD controller on board to reduce component costs
- Space saving packages for small design flexibility



Microcontroller Overview

NEC ELECTRONICS Flash microcontrollers provide solutions that give you the flexibility in peripheral integration needed to meet the design requirements of the Healthcare market.

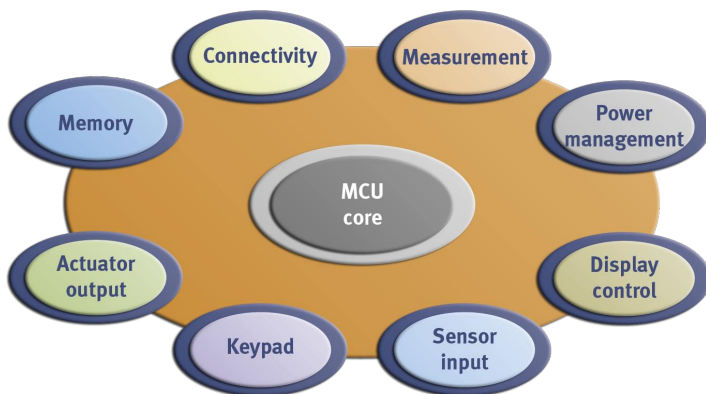
Common solution features versus requirements:

Performance

- Ultra low power microcontrollers: 3µAmps standby mode (32.768 KHz)
- High performance proprietary CPU
 - 8-bit 2 MIPS
 - 16-bit 13 MIPS
 - 32-bit 29 MIPS with the V850ES core, up to 400 MIPS with the V850E2 core
- 1.8V to 5.5V operation over full industrial temperature range (extended grades available)
- 1KB to 1Mb of high density, single voltage Flash memory
- Multi-channel 10-bit ADC – 2.6 µs conversion time
- 30mAmps GPIO
- Internal oscillators
- Stand-by operation modes with fast wake-up
- CSI, UART, IIC peripheral interfaces
- 8- and 16-bit timer/event counters

Reliability

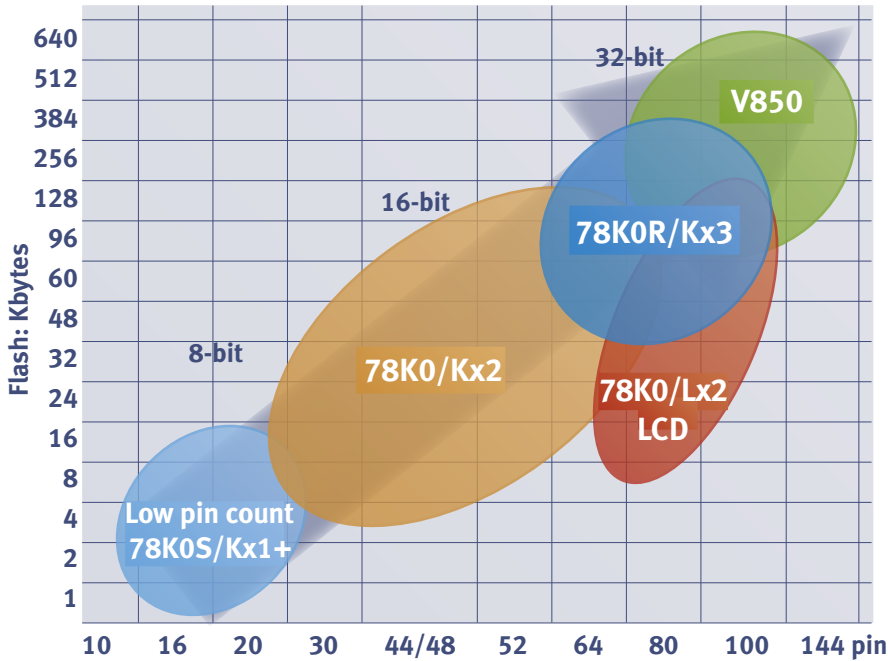
- Improved safety: LVI, POC
- Reliable programming method
- Secure self-programming
- Secure boot loader update
- Flash memory with security features
- High quality and reliability of our products
- Quality management system automotive and standard ISO9001
- Concept of form-fit-function with pin compatibility
- Low EMI noise and high EMS performance



Enhancements

- Space saving packages with the smallest micro: 16-pin, 2mm x 2mm
- Human machine interface solutions with Embedded GUI software
- LCD controller/driver up to 160 segments on board for glass LCD
- Keypad interface decoding
- Audio tone generation
- Wireless software solutions
- Dedicated application notes to support development

Microcontroller Portfolio



V850ES S/H/Jx2 Series (32-bit)

- High CPU performance 29 MIPS @ 20 MHz
- Internal PLL
- Peripheral integration
- Wide memory range

78K0R Kx3 Series (16-bit)

- Class leading performance/power consumption
- Alternative to 8-bit for higher performance
- Wide memory range
- 78K0 upward compatibility

78K0 Lx2 Series (8-bit)

- Expansion of Kx2 Series
- Built-in LCD controller/driver
- 32 KHz clock operation

78K0 Kx2 Series (8-bit)

- High speed operation
- Wide memory range
- Low power consumption
- Choice of peripheral integration

78K0S LPC Series (8-bit)

- Ideal for cost sensitive applications
- 10 MHz CPU operation
- 10-pin with 10-bit ADC
- World smallest micro

Device Features

Series	CPU	Performance	Memory range	Package range	Series	Peripherals
78K0S/Kx1+	78K0S (8-bit)	1.1 MIPS @ 10 Mhz	1 KB to 8 KB	10-pin, 16-pin, 20-pin, 30-pin	Low Pin Count: smallest micro	with/without 10-bit ADC, 8 MHz oscillator, PWM, UART
78K0/Kx2	78K0 (8-bit)	2.9 MIPS @ 20 Mhz	8 KB to 128 KB	30-pin, 44-pin, 52-pin, 64-pin, 80-pin	General purpose: choice of peripheral integration	ADC, subclock operation, 16-bit timers, UART/CSI/IIC
78K0/Lx2	78K0 (8-bit)	2.9 MIPS @ 20 Mhz	16 KB to 128 KB	64-pin, 80-pin, 100-pin	Built-in LCD controller up to 164 segments	Kx2 peripherals and LCD controller on board
78K0R/Kx3	78K0R (16-bit)	13 MIPS @ 20 Mhz	64 KB to 256 KB	64-pin, 80-pin, 100-pin	High performance with abundance of peripherals	Timer array, serial array, external bus, ADC, DAC
V850ES/Hx2	V850ES (32-bit)	29 MIPS @ 20 Mhz	64 KB to 256 KB	64-pin, 80-pin, 100-pin, 144-pin	5V, multi-channel ADC	Multiple serial interface
V850ES/Jx2	V850ES (32-bit)	29 MIPS @ 20 Mhz	128 KB to 640 KB	100-pin, 144-pin	3V high speed operation	DMA, external bus interface, ADC, DAC
V850ES/Sx2	V850ES (32-bit)	29 MIPS @ 20 Mhz	256 KB to 1 MB	100-pin, 144-pin	3V high memory range	DMA, external bus interface, ADC, DAC

Tools & Support

NEC ELECTRONICS MCU products are supported by high quality tools:

- C/C++ IAR compiler for all CPUs as well as the GreenHills Compiler for 32-bit V850 CPUs
- Low cost Starter kits
- On chip debug tools (Minicube)
- Fully featured low cost emulator (IECube)
- Dedicated European engineering support

Quality Grade Guidelines

NEC ELECTRONICS classifies the required quality grades needed for medical device as per FDA - Food & Drug Administration classifications:

- Class 1 devices - Standard quality grade (S)
- Class 2 Diagnostic devices - Standard quality grade (S)
- Class 2 Dosing devices - Special quality grade (A)*
- Class 3 devices - not supported by NEC ELECTRONICS i.e. pacemaker, defibrillator, internal body devices

* Subject to availability

TFT Technology

NEC ELECTRONICS believes that “superior equipment demands a superior TFT”.

To meet the diverse needs of the huge range of healthcare TFT applications - panel computers, programmable displays, measurement instruments, multimedia terminals, high-end monitors and other medical applications – NEC ELECTRONICS offers an extensive product lineup.

	3.5 inch	5.5 inch	6.3 inch	6.5 inch	8.4 inch	10.4 inch	12.1 inch	15.0 inch	19.0 inch	20.1 inch	21.3 inch
QSXGA 2560 x 2048 (5 M pixels)										NL256204 AM15-01A	
QXGA 2048 x 1536 (3 M pixels)											NL204153 BM21-01A
UXGA 1600 x 1200 (2 M pixels)											NL160120 BM27-06A
SXGA 1280 x 1024 (1 M pixels)									NL128102 BM29-05A		
XGA 1024 x 768			NL10276 BC12-02		NL10276 BC16-01	NL10276 BC20-04	NL10276 BC24-13	NL10276 BC30-17			
SVGA 800 x 600					NL8060 BC21-02	NL8060 BC26-27	NL8060 BC31-20				
VGA 640 x 480				NL6448 BC20-18D	NL6448 BC26-08D	NL6448 BC33-53					
QVGA 320 x 240	NL2432 HC22-40J	NL3224 BC35-20									

Note: for detailed specifications, please visit www.eu.necel.com/displays

Benefits and features of NEC ELECTRONICS' TFT solutions

Performance	<ul style="list-style-type: none"> • High luminance • High definition • High contrast • Quick response
Reliability	<ul style="list-style-type: none"> • Long term support for healthcare applications requirements • Wide operating range for intensive use
Enhancements	<ul style="list-style-type: none"> • Extended choice of small to large colour TFT LCDs • Ultra-wide viewing angle, reduced color shift • Monochrome and colour TFT LCD's

Advanced SFT Technology

- Enhanced transmissive panels
- Standard screen resolution
 - QSXGA:Quantum Super XGA
 - QXGA:Quantum XGA
 - UXGA:Ultra XGA
 - SXGA:Super XGA
 - XGA:eXtended Graphic Array
 - VGA:Video Graphic Array
 - SVGA:Super VGA

SFT: Super Fine TFT

Application	Screen size	Part Number	Resolution	Display color	Lumination	Contrast	Viewing angle	Interface
Mammography	20.1 inch	NL256204AM15-01A	2560 x 2048	766 gray scales	850 cd/m ²	600:1	85° U/D/R/L	4 port LVDS LCR
MRI, CT	21.3 inch	NL204153BM21-01A	2048 x 1536	766 gray scales	800 cd/m ²	700:1	85° U/D/R/L	4 port LVDS LCR
MRI, CT	21.3 inch	NL160120AM27-06A	1600 x 1200	766 gray scales	1800 cd/m ²	600:1	85° U/D/R/L	2 port LVDS LCR
X-ray	19.0 inch	NL128102BM29-05A	1280 x 1024	766 gray scales	1000 cd/m ²	900:1	85° U/D/R/L	2 port LVDS LCR
Patient monitor	15.0 inch	NL10276BC30-17	1024 x 768	16,777,216 colors	350 cd/m ²	700:1	85° U/D/R/L	1 port LVDS RGB

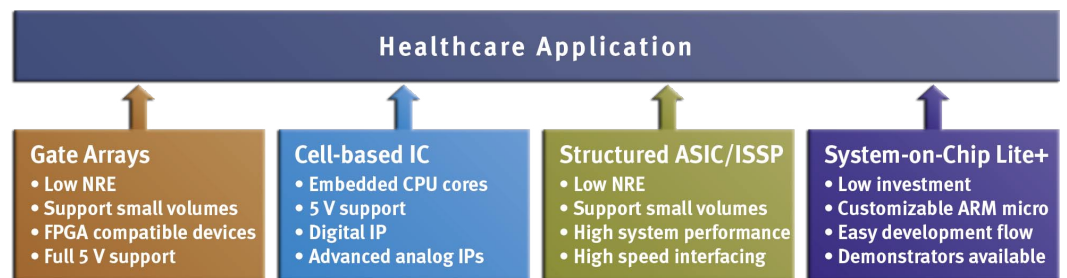
Other Key Products

ASIC

Using ASIC technology allows customers to integrate exactly those functions that ideally suit their equipment, making use of the benefits of the underlying process technology (e.g. low-power, high-speed, etc).

- Own wafer production for all ASIC technologies
- High-speed measurement and data manipulation for advanced diagnostics
- Networking for laboratory equipment
- HMI and diagnostic controls
- Laboratory equipment
- Data encryption (e.g. patient data handling)

www.eu.necel.com/asic



USB2.0



NEC ELECTRONICS is the market leader in providing USB2.0 certified devices, as well as having industry leading data transmission rate and power consumption levels, we also provide reference design to reduce development time.

Product line up:

- Host controllers
- Hub controllers
- IDE bridges
- Function controllers
- Wireless USB (hub & host)

www.eu.necel.com/usb

Power MOSFET



NEC ELECTRONICS solutions reflect our extensive engineering expertise and our comprehensive insight into our customers' applications to reflect the numerous power management functions found in healthcare market.

- Portfolio contains over 750 devices
- Complete range from low voltage to high voltage MOSFET
- All popular packages available including ultra small packages, high current packages and bare die
- Class leading UMO54 process featuring ultra low on-resistance, lower gate charge and lower leakage current

www.eu.necel.com/mosfet

Opto-Electronic devices



NEC ELECTRONICS offers over 400 different optocoupler devices to provide optimal performance, reliability and quality to meet the requirements of many healthcare/medical instruments.

- 3.3 V operating Voltage
- High CMR: 15KV/us min
- High speed CMOS output
- Smallest package: Flat lead

www.eu.necel.com/opto

Microwave Devices



NEC ELECTRONICS provide solutions in both discrete and packaged high frequency microwave devices suitable for various communication systems.

- IC products: Amplifiers, convertors, switches, transceivers
- Discrete products: Low noise bipolar SiGeHBT Power transistor / MOSFET
- MCM: Push-pull amplifiers, power doubler amplifiers

www.eu.necel.com/microwave

NEC Electronics Corporation
Kawasaki, Japan
Tel: 044-435 5111
Fax: 044-435 1667

NEC Electronics Inc. (U.S.)
Santa Clara, California
Tel: 408-588-6000
Fax: 408-588-6130

NEC Electronics (Europe) GmbH
Duesseldorf, Germany
Tel: 0211-65 030
Fax: 0211-65 03 1327

Sucursal en España
Madrid, Spain
Tel: 091- 504 27 87
Fax: 091- 504 28 60

Succursale Française
Vélizy-Villacoublay, France
Tel: 01-30-67 58 00
Fax: 01-30-67 58 99

Filiale Italiana
Milano, Italy
Tel: 02-66 75 41
Fax: 02-66 75 42 99

Branch The Netherlands
Eindhoven, The Netherlands
Tel: 040-265 40 10
Fax: 040-244 45 80

Tyskland Filial
Taeby, Sweden
Tel: 08-638 72 00
Fax: 08-638 72 22

United Kingdom Branch
Milton Keynes, UK
Tel: 01908-691-133
Fax: 01908-670-290

Mobile Platform Solutions
Reading, UK
Tel. 0118-916 9800
Fax 0118-916 9822

NEC Electronics Hong Kong Ltd.
Hong Kong
Tel: 2886-9318
Fax: 2886-9022/9044

**NEC Electronics Hong Kong Ltd.
Seoul Branch**
Seoul, Korea
Tel: 02-528-0303
Fax: 02-528-4411

NEC Electronics Singapore Pte. Ltd.
Singapore
Tel: 65-6253-8311
Fax: 65-6250-3583

NEC Electronics Taiwan Ltd.
Taipei, Taiwan
Tel: 02-2719-2377
Fax: 02-2719-5951

Internet:
www.eu.necel.com/healthcare

E-mail:
healthcare@eu.necel.com

All product, brand, or trade names used in this pamphlet are the trademarks or registered trademarks of their respective owners. Product specifications are subject to change without notice. To ensure that you have the latest product data, please contact your local NEC Electronics sales office.

© Published by NEC Electronics (Europe) GmbH
Printed in Germany, August 2006
Document No. U18254EE1V0PF00