

To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

Send any inquiries to <http://www.renesas.com/inquiry>.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.
 - “Standard”: Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.
 - “High Quality”: Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.
 - “Specific”: Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

8-BIT ULTRA-LOW-POWER LCD MCUS

NEC ELECTRONICS AMERICA

Highly optimized, high-performance, 150 nm flash process technology provides the 78K0/Lx3 microcontrollers with low power operation at full speed (10 MHz) and very low power consumption in Standby/HALT modes (1 μ A typical in STOP, 2.4 μ A typical in HALT mode with 32 kHz/real-time clock running). Dense flash memory provides 6 bits ECC on every 32-bit word to protect against any rare flash data retention failures in long-term field usage (15-20 years).

LCD-resistive ladder drive allows up to 160 (x 4) or 288 (x 8) LCD segment display. High-performance CPU processing, generous GP I/O lines and peripheral functions enable the electronics hardware/software designer greater flexibility and ease-of-use. NEC Electronics' well-designed system silicon makes the best use of multiple, scalable system clocks for high-performance, optimum power savings, while die layout techniques minimize EMI and noise. NEC Electronics' 0.15 μ silicon process and on-chip voltage regulator enable a wide voltage supply operating range from +1.8V to 5.5V and wide ambient temperature operating range of 40 $^{\circ}$ C to +85 $^{\circ}$ C.

78K0/Lx3 Microcontrollers

Key Features and Benefits

Features	Benefits
Low-power, 8-bit 78K0 flash MCU, 1.8V to 5.5V operation	Flexible LCD controller/driver for low-cost, handheld portable designs
Low-power performance, 2.2 mA typical @ 10 MHz	Long battery life and energy-efficient product implementation
8 KB to 60 KB flash memory, 512 B to 3 KB SRAM	150 nm flash process enables low-power operation at full speed (capable of in-circuit programming, self programming and flash EEPROM emulation)
Internal 8 MHz (+/-5%) main and 240 kHz watchdog oscillators	Minimizes total system cost, reducing PCB footprint, while lowering power consumption
1 ch 16-bit and 6 ch 8-bit timers	Monitors/counts/measures multiple external events and provides timing to external peripherals
Real-time counter (RTC) clock/calendar function, 2.4 μ A typical in 32 kHz HALT mode	Very low power consumption; no CPU intervention for time-of-day function; 99-year calendar with leap-year function
Hardware safety features: windowed watchdog timer (with independent 240 kHz internal OSC), power-on-clear (POC) reset, low-voltage indicator (LVI)	Internal circuits provide bullet-proof CPU operation over wide battery voltage, lowering total system costs
3 ch 16-bit sigma-delta A/D convertor	High-resolution ADC enables high-precision reading of analog input for instrumentation and measurement systems

16-bit ADC 3 ch LE3 and LF3	78K0 8-bit CPU Core 10 MHz Operating Voltage 1.8V – 5.5V		LCD Controller 22 – 288 Seg. Ladder Resistor
10-bit ADC 6 – 8 ch	Flash 8 KB – 60 KB	RAM 512 B – 2 KB	Watchdog Timer
CSI (SPI) 1 – 2 ch			16-bit Timer 1 ch
UART 2 ch	Sub-Clock 32.768 kHz	Low-Voltage Indicator 16 Selectable Voltages	8-bit Timer 6 ch
Total IOs 30/34/46/62	Internal OSC 240 kHz	On-Chip Debug	Real-Time Counter (Calendar)
Key Interrupt 3 – 8 ch	Internal OSC 8 MHz +/- 5%	Power-On Clear (1.59V +/- 0.15V)	Clock Output 32 kHz – 10 MHz
Remote Receiver Controller			
Manchester Code Generator			

NEC Electronics America, Inc.
2880 Scott Boulevard
Santa Clara, CA 95050-2554
+ 1 (408) 588-6000
www.am.necel.com

NEC Electronics Corporation
1753 Shimonumabe, Nakahara-Ku
Kawasaki, Kanagawa
211-8668, Japan
+81 (44) 435-5111
www.necel.com

NEC Electronics (Europe) GmbH
Arcadiastr. 10
40472 Düsseldorf, Germany
+49 (211) 6503-0
www.eu.necel.com

Target Applications

- Low-cost, handheld designs, including:
- › Consumer healthcare equipment
 - Blood glucose meters
 - Thermometers
 - Blood pressure monitors
 - › Building management
 - Thermostats
 - Security
 - HVAC control panels
 - › Irrigation control panels
 - › Water filter control panels

Development Tools

Demokit LF3 evaluation kit for 80-pin device

- › Flash programming and on-board debugging via USB interface

Software development tools

- › CubeSuite™ integrated development environment
- › C-compiler, assembler, software debugger, code generator

Hardware tools

- › Full-function IECUBE™ in-circuit emulator, including real-time trace
- › MINICUBE2™ (QB-MINI2-EA) on-chip debug emulator and in-system flash memory programmer
- › Stand-alone flash programmer (PG-FP5-EA)

Ordering Information

μPD78xxxxyy-zzz-AX

Flash Memory	RAM	xxxx Body Part Number			yy-zzz Package Suffix	RoHS Plating (NiPdAu)
		No ADC	10-bit ADC	16-bit sigma delta ADC		
8 KB	512 B	0400	0410	-	GA-GAM 48-pin plastic; LQFP (7 × 7)	-AX
16 KB	768 B	0401	0411	-		
24 KB	1 KB	0402	0412	-		
32 KB	1 KB	0403	0413	-		
8 KB	512 B	0420	0430	-	GB-GAG 52-pin plastic; LQFP (10 × 10)	
16 KB	768 B	0421	0431	-		
24 KB	1 KB	0422	0432	-		
32 KB	1 KB	0423	0433	-		
16 KB	768 B	0441	0451	0461	GB-GAH 64-pin plastic; LQFP (10 × 10) GK-GAJ-AX 64-pin plastic; LQFP (12 × 12)	
24 KB	1 KB	0442	0452	0462		
32 KB	1 KB	0443	0453	0463		
48 KB	2 KB	0444	0454	0464		
60 KB	3 KB	0445	0455	0465	GC-GAD 80-pin plastic; LQFP (14 × 14) GK-GAK 80-pin plastic; LQFP (12 × 12)	
16 KB	768 B	0471	0481	0491		
24 KB	1 KB	0472	0482	0492		
32 KB	1 KB	0473	0483	0493		
48 KB	2 KB	0474	0484	0494		
60 KB	3 KB	0475	0485	0495		

For device or tools availability and pricing, contact an NEC Electronics America sales representative.