

GLEICHMANN Newsletter

Empowered by Innovation



Gleichmann Ultratec signs distribution agreement with KDS Daishinku

KDS Daishinku, a Japanese manufacturer of quartz, and Gleichmann Ultratec, a Swiss daughter company of Gleichmann Electronics, have signed a European-wide distribution agreement.

With a total of ten factories in Japan and South East Asia, KDS Daishinku Corp. - which was founded in 1959 - is one of the worldwide leading manufacturers of quartz, crystal resonators, crystal

the decision for Gleichmann Ultratec as sales partner was above all based on the experience and technical competence of Gleichmann Ultratec's employees in their handling with quartz products. "Customer satisfaction is the first priority for KDS. With Gleichmann Ultratec, we have found a partner, who absolutely shares this philosophy with us. The cooperation with Gleichmann Ultratec puts

For Hans Eggensberger, managing director of Gleichmann Ultratec, the cooperation with KDS Daishinku is an ideal enhancement to the existing product portfolio. "Most of the products feature an extended temperature range from -40°C to +150°C as well as high vibration resistance and shock resistance. This therefore, allows these high quality products to be used with virtually no restrictions in various security, medical, automotive and telecommunications applications."

According to Hans Eggensberger, an additional advantage of KDS's balanced product portfolio is the availability of various packages, which allows an exact replacement of products from other manufacturers. "This puts us in the position of being able to react and adopt even faster and more flexibly than before to our customers' wishes and requirements."



Emphasis on high quality quartz products and technical competence (from left to right): Hans Eggensberger, managing director of Gleichmann Ultratec, and Yoshitaka Tokuda, managing director of KDS Europe.

oscillators, monolithic crystal filters (MCF) and optical quartz products. According to Yoshitaka Tokuda, managing director of KDS Europe,

us in a position to be able to optimally support and advise our customers right up to the circuit design level," says Yoshitaka Tokuda.

V850ES/xx3 MCU family now complete

The third generation of NEC Electronics' V850 microcontroller (MCU) families (J series, F series, S series, I series and H series) features a further increase in

the processing speed and a significantly enhanced RAM and flash memory area. In addition, the 'family concept' has been further developed, guaranteeing a continua-

tion of full software and pin compatibility.

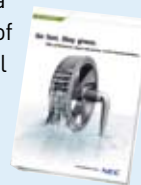
For the J series (V850ES/Jx3), the clock rate was increased (Continued on page 2)

Spotlights

SanDisk 'Mobile Products' also available immediately from Gleichmann Electronics

Since May 1, 2008, Gleichmann Electronics is now also official distributor for SanDisk 'Mobile Products'. The product portfolio includes microSD cards with memory capacities from 256 MB to 8 GB as well as the Memory Stick Micro (M2) family, which is also offered with memory capacities from 256 MB to 8 GB. Since the year 2000, the sister company MSC has already worked together successfully in many fields with the global leader in flash memory.
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Are you already aware of NEC Electronics' latest generation of 16-bit All Flash™ microcontrollers? Why the 78K0R/lx3 series is ideally suited to meet the demands of a wide variety of motor control applications can be read starting on page 2.



Highlights

- 78K0/lx3 series 16-bit All Flash microcontrollers...
- Lithium-ion: Demand outstrips supply
- SSD1961 graphic controller - low power and low-cost link....
- 7.0-inches and 15.3-inches displays with 16:9 format
- Maximized performance in a miniaturized package and many more...

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V850ES/xx3 MCU family now complete

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to 32 MHz and the memory area enlarged up to 1 Mbyte. Four ultra-low power consumption derivatives (V850ES/Jx3-L) in 80-pin and 100-pin packages are completely new to this series. Because of the low power consumption of 0.9 mW/DMIPS and an operating voltage range from 2.2 V to 3.6 V, these devices are optimally suited for battery-driven applications that demand a high computing power. During this year, it is planned to enhance the family with further derivatives (V850ES/Jx3-U & Jx3-H) having a clock rate of 48 MHz maximum as well as USB and CAN interfaces.

The F series, which is specially designed for CAN and automotive applications, also incorporates enhanced technical features. The new generation is equipped with features including, an internal 8 MHz oscillator, a data flash and flexible 3-phase timers. In addition, with the most powerful version, the device has two A/D convert-

ers with a total of 40 x 10-bit channels. The two A/D converters enable a synchronous reading of values and therefore, offer a high level of flexibility, especially with respect to motor control applications.

Furthermore, for cost-sensitive applications the user is also now provided with the V850ES/Fx3-L family, a scaled-down version of the V850ES/Fx3 family with less peripheral blocks, 20 MHz maximum clock frequency and smaller memory.

For the V850ES/Sx3 family, which is also specially designed for the automotive sector, the clock rate is now

32 MHz maximum and the flash memory size has been enhanced up to 1 Mbyte. The derivatives are available both with CAN interface and without CAN interface.

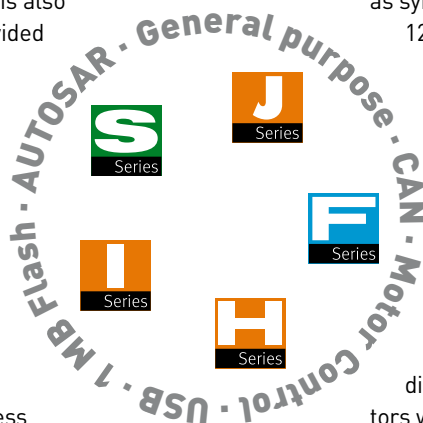
New, especially for motor control applications optimized peripheral blocks such as synchronous 12-bit A/D converters, 3-phase timers, comparators and op-amps, enable flexible control of different motors with the 32-bit MCUs of the V850E/Ix3 series. The devices of the third generation are available with clock speeds of up to 64 MHz.

The newest general purpose MCUs of the V850ES/

Hx3 series are fully software and pin-compatible to previous generations. The maximum clock rate was also increased to 32 MHz and additionally, an 8 MHz oscillator integrated on-chip.

In addition to the GHS or IAR software development environments and the on-chip debuggers, QB-MINI2 or QB-V850MINI, a full in-circuit emulator (IECUBE) as well as starter kits and software examples are also available to designers for all product families.

Furthermore, a number of different software accessories, both from NEC Electronics and third party suppliers, are offered, e.g.: AUTOSAR, various operating systems or also communication stacks such as CAN, CANopen, LIN, IO-LINK, ZigBee, TCP/IP, and many more.



78K0R/Ix3 series 16-bit All Flash™ microcontrollers – also the right choice for demanding motor controls

You have the task of designing a motor control in a small quantity, there is plenty of space available and the component costs play a secondary role? Congratulations, you have indeed hit the jackpot. However, as a rule, especially designers of motor controls are confronted with a variety of adversities, which make the selection of an optimal motor control more of an ordeal than a simple choice.

For example, the charging control in a battery-powered drive solution in standby mode must be displayed on a small display, a controlled volume (dosing) pump may only have minimal deviations

and requires an exact rotation regulation or the control of a battery-driven miniature motor should have a high performance however, the power consumption should be as low as possible. Maybe a controller is required, which can control the grinder, dosing pumps, communication and user guidance of a coffee machine and at the same time possibly integrate lots of peripheral hardware in order to save costs and save space. These few examples demonstrate how diverse and different the requirements nowadays are for microcontrollers in the field of motor controls.

In the meantime, the spectrum of functions for microcontrollers ranges from simple on/off brush-commutated motors to complex multi-axial position controlled, high dynamic electronic-commutated 3-phase DC (BLDC) motors. By the way, BLDC motors are becoming more important – not just because of their significantly higher efficiency compared to normal DC motors. The simple mechanical construction and considerably lower wear are also advantages of this type of motor. Moreover, they are smaller, more rugged and efficient, and allow more freedom of choice for the control.

Performance is available in abundance

Those of you who have been involved for a long time with the topic of motor control know that nowadays, the control of BLDC motors is no longer an issue. Six years ago, 2 to 3 MIPS had to be sufficient for the implementation of an exact 3-axis position control in 250 µs cycle. In the meantime, modern controllers such as NEC Electronics' 78K0R/Ix3 series of 16-bit All Flash™ MCUs at 20 MHz clock frequency easily achieve a processing performance of 13 MIPS.

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It is no longer necessary to look for new tricks, to the contrary: plenty of performance remains for other functions.

Ideally suitable for BLDC motor controls

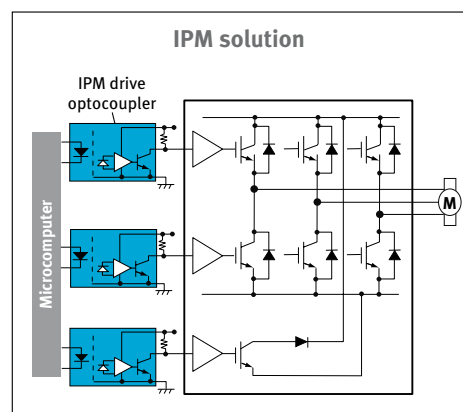
The 78K0R/Ix3 series of microcontrollers is designed especially for motor control applications and already integrates on chip all of the essential circuits for motor control, including an operational amplifier, comparators, and high-speed A/D converters (2 μ s) with operational amplifier (op amp).

Additionally, depending on the version, other features are a 2- or 3-phase timer including 16-bit timer and dead time generation as well as a watchdog timer. The low number of additional external components required not only guarantees more dependability and efficiency during the design phase.

Furthermore, it also helps the user to reduce the bill of materials cost and save space on the system board.

The MCUs are built around the 16-bit 78K0R CPU core and feature extremely low power consumption in comparison to many other microcontrollers. With only 1.8 mW per MIPS even the implementation of demanding battery-powered drive solutions in a small space should essentially not be a problem.

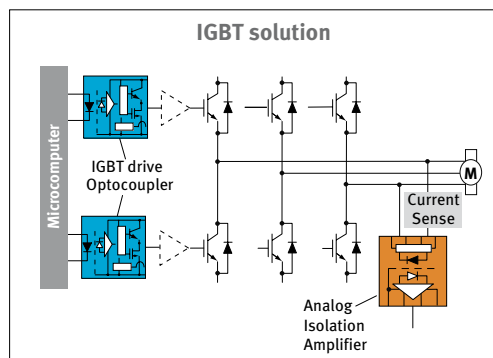
NEC Electronics' new MCUs allow fine-grained control of various types of 1-, 2- and 3-phase motors. The flash memory configuration possi-



flash memory and 1 to 3 KB of internal RAM - allow for flexible updating of the software even after the MCU is mounted on the system board.

NEC Electronics' MCUs are supported by a comprehensive suite of development tools including the MINICUBE2 (on-chip debugger), the IECUBE emulator (FULL ICE), diverse compiler suites as well as numerous starter kits and software tools. Furthermore, a 24 volt evaluation kit and a high voltage evaluation kit are offered for a quick start.

Packaging options include SSOP and LQFP packages in pin counts ranging from 30 to 64 pins. Product literature for the 78K0R/Ix3 MCUs is available immediately from Gleichmann Electronics. Samples are expected to be available in July 2008.



bilities of the entire series - depending on device type, available memory configurations range from 16 to 64 kilobytes (kB) of internal

Fast optocoupler for high voltage AC or DC motor drives

NEC Electronics' fast IGBT drive optocouplers PS9552 and PS9553 are ideal for AC or DC motor control applications. The devices consist of an optically coupled isolator with a GaAlAs LED and a high output voltage and current. Features of the devices include a high output current of 2.0 A (PS9552) and 0.5 A (PS9553). Additional characteristics include a transmission speed of 1 Mbit/s, 5000 VRMS isolation voltage, > 0.4 mm isolation distance and > 8 mm outer creepage distance. With 15 kV/ μ s common mode ratio (CMR), the device has an excellent value for this particularly critical parameter. Furthermore, with an operating voltage range from 15 V to 30 V and an operating temperature range from 40°C to +100°C, the optocouplers PS9552 and PS9553 are very flexible in their usage.

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Workshop: "Development of PROFINET products"

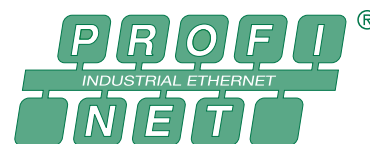
PROFIBUS Nutzerorganisation e.V. (PNO) is hosting a workshop in Frankfurt, Germany on June 24-25, 2008. Specialists from Gleichmann Electronics and other leading technology companies will inform about the development possibilities of PROFINET products and

present ways to develop PROFINET products. The workshop language will be English.

The main topics of the workshop include: PROFINET functions from the view of Conformance Classes, IRT concept, Fast Start-Up, TCI (Tool Call-

ing Interface) and iParamater-Server.

In addition, the speakers will report about experiences from current implementations and give advice for product development. Attendance at this workshop is free of charge.

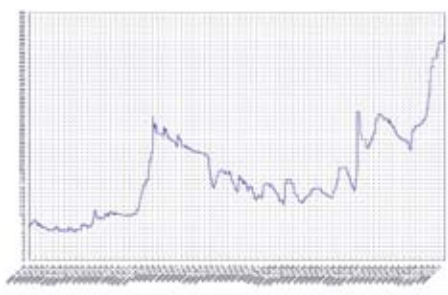


Further information about the workshop can be obtained by contacting:

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Lithium-ion: Demand outstrips supply

Even though, in the meantime (after the fire at the manufacturing plant at the end of September 2007) production of Matsushita Battery Industrial Co., Ltd. (MBI) lithium-ion rechargeable batteries have been allotted to various locations and full production capacity has once again been resumed, there is currently no easing of the market tension in sight. To



Price trend of cobalt, April 2002 – February 2008

the contrary, demand will probably remain significantly higher than the supply and this is expected to continue well in to the second half of this year.

One of the major reasons for this is the increasing demand for lithium-ion products. Those currently placing new orders for cells from LG, Panasonic, Samsung, Sanyo or Sony must be prepared to accept delivery times of up to nine months. Nobody can rule out that delivery conditions will substantially worsen in the coming weeks. Market researchers predict that the second fire at a lithium-ion rechargeable battery production plant within a few months – this

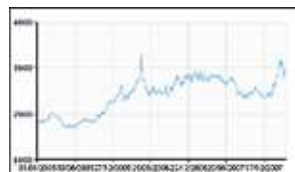
time, at LG Chem – could lead to production losses of many millions of cells per month till at least the middle of this year. Above all, victims of this development could be new and existing European customers. This is no surprise when one considers the numbers.

The European market share of the worldwide demand for lithium-ion rechargeable batteries is not more than 8% to 10%. To make the proportions clear: Laptop manufacturers alone claim significantly more than 20% of the lithium-ion rechargeable batteries market. With so much market power, it is obvious who will have the disadvantage during allocation times.

Less positive news also comes from the pricing situation. Since the end of 2007, prices for precious metals and alloys such as aluminum, copper and cobalt have once again significantly increased. In order not to endanger the development of the lithium-ion rechargeable batteries market, manufacturers have in the past absorbed the price increases in the hope of a rapid stabilization. However, nobody will risk serious predictions whether in the medium-term a lasting relaxation will return. The booming economies of China

and India with yearly growth rates of far more than 5% lead us to believe that the upward price spiral for raw materials will continue and therefore, sooner or later lithium-ion cells will become more expensive.

Despite the tense delivery situation and further market price alignment in 2008, we at Gleichmann Electronics assume that the number of new designs of applications with lithium-ion rechargeable batteries will nonetheless, also continue to increase in 2008. The advantages and performance characteristics of this

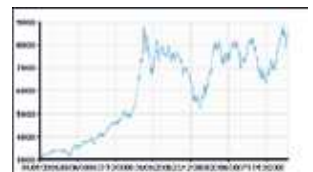


Price trend of aluminum, January 2005 – March 2008

technology for the users are in the meantime too remarkable and obvious. Furthermore, in the meantime there are a number of interesting alternatives to lithium-ion cobalt cells, which are particularly affected by the current delivery limitations. These alternatives only differ slightly in price performance ratio relative to performance and size. For example, whereas with lithium-ion cobalt cells only the double capacity is available as peak current, lithium-ion manganese cells offer between 10C and 30C and lithium-ion iron-phosphate cells even

more – up to 80C.

Furthermore, in particular with lithium-ion iron-phosphate cells, nowadays after more than 1,000 life cycles more than 80% of the effective capacity is still available. Compared to lithium-ion cobalt the other two lithium-ion technologies described here offer less capacity per cell, however on the other hand offer additional safety. Last, but not least some small comfort: Even if the prices for lithium-ion rechargeable batteries should continue to climb higher, the costs for the complete lithium-ion pack solution do not necessarily



Price trend of copper, January 2005 – March 2008

have to increase at the same rate. This is because; by far, not all components of an intelligent rechargeable battery pack are affected by the lithium-ion price increase.

Do you have questions regarding the lithium-ion battery market and would you like to know which solutions we can offer? We look forward to hearing from you soon to discuss your specific inquiries.

Free microcontroller seminar

Attend the free, one day microcontroller seminar for Swiss engineers at the offices of Gleichmann Ultratec AG

in Volketswil, Switzerland on June 24, 2008 and you will be presented with an introduction of the newest 8-bit, 16-bit

and 32-bit microcontrollers from NEC Microelectronics. Registration details can be obtained by contacting:

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SSD1961 graphic controller - low-power and low-cost link between microprocessor and display

Solomon Systech has introduced the SSD1961 graphic controller for mobile applications including smartphones and portable media players (PMPs), but also for energy sensitive applications such as room temperature controllers or controls for window blinds. The SSD1961 supports resolutions of up to 640 x 480 pixels (VGA) at up to

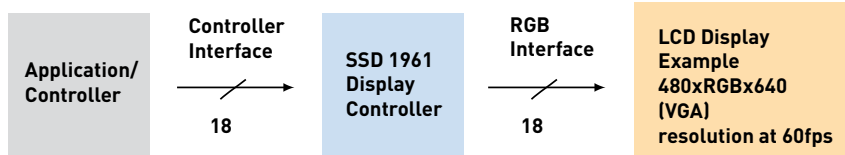
18-bit color depth. Furthermore, key product features of the device include 675 Kbytes of embedded display

SRAM, which serves as frame buffer between the host processor and the LCD display.

The on-chip integrated LCD and MCU interfaces reduce the wiring effort to a minimum. The SSD1961 supports different types of monochrome, color, active and passive LCD

displays including 4/8-bit monochrome/color STNs, 12/18-bit active matrix TFTs and 16-bit HR TFTs with 160 x 160 pixels and 320 x 240 pixels. The universal built parallel 8/16-bit controller interface enables the connection of CPUs from different manufacturers.

The SSD1961 contains



to reduce backlight power consumption by up to 50%.

The four general-purpose inputs/outputs (GPIOs) require a supply voltage of between 1.8 V and 3.3 V and the controller core itself 1.2 V. The SSD1961, with dimensions of only 5 mm x 5 mm, is available in a 64-pin TF-BGA (Thin Fine-pitch Ball Grid Array) package.

Solomon Systech has announced that in the fourth

an integrated graphic engine, which allows display rotation of 90°, 180° and 270°. The hardware implemented display rotation is significantly more efficient than the usual software solutions, where the content of the display buffer must be entirely rewritten every time. The graphic en-

contrast and color saturation can each be separately set and programmed.

To extend the battery life in mobile applications, the SSD1961 uses an innovative dynamic backlight control technology. The sophisticated algorithm of this technology helps

quarter of 2008 it will introduce a further graphic controller, which will support the new WVGA (Wide VGA) with 800 x 480 pixels resolution and 24-bit color depth.

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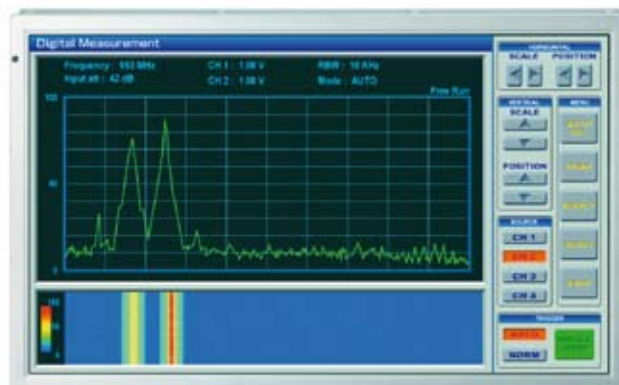
Displays with 16:9 format set new standards in the field of industrial visualization

The 16:9 format is not yet established in industrial use. Most applications for process visualization or presentation of images are still designed with the 4:3 format. Nonetheless, the interest for such displays is constantly growing, because the 16:9 format is more natural to the human eye's field of vision and therefore offers an enormous variety of applications.

One of the current highlights in this field is NEC LCD Technologies'

brand-new 7.0 inches (18 cm diagonal) TFT display NL8048BC19-02, which is designed mainly for industrial applications. The NL8048BC19-02 not only features an above average long lifetime backlight, but also long-term availability.

The NL8048BC19-02, built using twisted nematic (TN) technology, has a resolution of 800 x 480 pixels and is controlled via a selectable 6-bit or 8-bit low-voltage differential signaling (LVDS) interface.



Luminance is 400 cd/m² and contrast ratio 1000:1.

A sophisticated foil technology allows both horizontal and vertical viewing angles of 160° typical. An

additional guarantee for optimal viewing conditions is the integrated reverse scan function. If required, this allows the user to rotate the

(Continued on page 6)

Displays with 16:9 format set new standards in the field of industrial visualization

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image 180 degrees so that it can be mounted - depending on the application - to operate with optimal viewing angle.

The easily replaceable LED backlight with a lifetime (MTTF) of 50.000 hours (typ.)



allows a low power consumption of approximately 3 Watts. With compact outline dimensions of 170.0 (W) x 111.0 (H) x 8.5 (D) mm and an operating temperature range of -20°C to +70°C, the NL8048BC19-02 is an ideal choice to meet the demands of many industrial applications.

By the way, a super-transmissive natural light TFT (ST-NLT) technology version of the 7.0-inches display with 16:9 format will also be available soon under the part number NL8048-BC19-02C. With the same power consumption, this

version offers a significantly higher luminance. By means of a clear polarizer with antireflective coating (ARC) and a reflective foil inside the display, which takes advantage of the ambient light as

additional light source, this version still guarantees an excellent readability even in very bright environments and with direct sunlight.

Also available with 16:9 format is the NL12876BC26-25, a 15.3-inches (39 cm diagonal) display. It is not only perfectly suitable for visualization tasks

in industrial automation, but also for point of information (POI) terminals, entertainment applications and for use in medical monitoring devices. The NL12876BC26-25 is built up in super-advanced, super-fine TFT (SA-SFT) technology, which is based on the - especially for industrial applications specified and enhanced - in-plane switching (IPS) technology. The panel's features include a high transmission and consequently a high luminance of 470 cd/m², a contrast ratio of 700:1, a very short (for this technology) response time of 25 ms and an extended operating temperature of -10°C to +70°C.

The SA-SFT technology guarantees a viewing angle of 85° typical on all four sides (up, down, left, right) without color reversal or color shift. The display can therefore be mounted horizontally (landscape) as well as vertically (portrait). By the way, the power consumption of the

display, which is equipped with four cold cathode fluorescent lamps (CCFLs), is only 18.0 W. The NL12876BC26-25 is controlled via an 8-bit LVDS interface.

One of the most convincing attributes of NEC TFT Displays is a long-term availability of four and even more years (based on past experience).

For each display version and the different fields of application, we offer a comprehensive range of accessories such as: suitable inverters, cable forms, touch systems and controller cards, both for analog RGB and video applications. You can also benefit from the advantages, which 16:9 format offers in a professional environment, and set new standards with your applications in the field of industrial visualization.

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Maximized performance in a miniaturized package



Gleichmann Electronics has in its product portfolio:

special microcontrollers from NEC Electronics Europe for sensor applications, intelligent relays, switches, keypads, toys or other end applications, which must be implemented in the smallest

possible space.

With dimensions of only 2 x 2 mm, the three derivatives of the K series are currently the smallest devices. Each of the 8-bit MCUs, available with different memory sizes, is provided with an internal 8 MHz oscillator and a 240 kHz oscillator for watchdog functions. Special features include a 10-bit A/D converter with a

conversion time of < 5 µs. In addition, an integrated power-on reset and the programmable low-voltage detection help to save external components.

The 16-bit area is covered by the 78K0R/Kx3 generation in 5 x 5 mm² BGA package. Furthermore, in addition to the above mentioned features such as internal oscillators,

low-voltage detection or power-on clear, members of the 78K0R/Kx3 series offer an innovative 16-bit timer array unit, a serial array unit as well as a real-time clock with watch function and calendar function.

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MCU	Memory	Pins/Package	Size	A/D Converter	Timer	Interfaces	Oscillators
78F921x	1k.. 4k Flash 128B RAM	16 / BGA	2x2 mm	4 x10 bit	1x 8 Bit, 1x 16 Bit, Watchdog	-	Internal: 8 MHz, 240 kHz, External: 10 MHz
78F050x	8k.. 32k Flash 512B.. 1B RAM	30 / LGA	4x4 mm	4 x10 bit	4x 8 Bit, 1x 16 Bit, Watchdog	1xCSI, 2xUART, 1xI ² C	Internal: 8 MHz, 240 kHz, External: 20 MHz
78F053x	16k.. 60k Flash 768B.. 3k RAM	64 / LGA	5x5 mm	8 x10 bit	4x 8 Bit, 1/2x 16 Bit, Watchdog, Watch-Timer	1/2xCSI, 2xUART, 1xI ² C	Internal: 8 MHz, 240kHz, External: max. 20 MHz, 32kHz
78F114x	64k.. 256k Flash 4k.. 12k RAM	64 / BGA	5x5 mm	8 x10 bit	8x 16 Bit, Watchdog, Real Time Clock	2xCSI, 3xUART, 1xI ² C	Internal: 8 MHz, 240kHz, External: max. 20 MHz, 32kHz

Powerful optocoupler family in 6-pin SDIP

NEC Electronics has newly introduced the IGBT drive optocoupler PS9301 and the high-speed couplers PS8302, PS9303, PS9313 and PS9317

in a 6-pin SDIP (Shrink Dual Inline Package) with pin pitch of 1.27 mm.

The 6 pin SDIP occupies about 50% less mounting area on the PCB than a comparable 8-pin DIP.

In the field of SMD, the shrink dual inline package contributes to a significant improvement of isolation characteristics. Some of the key features of the ICs, designed for 1Mbit/s and 10Mbits/s data transmission

speeds, are 5000 VRMS isolation voltage, 0.4 mm internal isolation distance and 8 mm outer creepage and air distance. Furthermore, thanks to

an integrated electrical shield, a common mode transient immunity (CMR) of at least 15 kV/ μ s is achieved.

This therefore makes the new optocouplers ideal for use in noisy environments.

Optocouplers of the

PS93/83xx family have each been optimized for various fields of application. For example, the PS8302 with 1 Mbit/s data transmission speed and 35 V output voltage rating is ideally suited for use in industrial communication. The same applies for the PS9317, a digital optocoupler with open-collector output and up to 10 Mbits/s data transmission speed.

The PS9313 optocoupler with IPM interface, open-collector output, up to 1 Mbit/s data transfer rates and a 35 V output voltage was specifically designed for use in motor

controls. On the other hand, devices of the PS9301 series for IGBT and MOSFET gate drives are designed for 0.6 A maximum output current and VCC ranging from 10 V to 30 V.

The PS9301, PS9303 and PS9317 optocouplers operate in the industrial temperature range from 0°C to 100°C and for the first time, the PS8302 and PS9313 with a guaranteed maximum operating temperature of up to 110°C. All five optocouplers are compliant with common international safety standards. Samples in different lead bending options, for through hole or as surface mount device, are available immediately from Gleichmann Electronics.



Product name	Output	Speed
PS8302	Analog	1 Mbps
PS9303	Digital, Totem Pole	1 Mbps
PS9313	Digital	1 Mbps
PS9317	Digital	10 Mbps
PS9301	IGBT drive	1 Mbps

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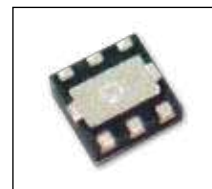
Mini-LNAs for mobile GPS applications

NEC Electronics has recently introduced two extremely low noise amplifiers for mobile GPS applications. The μ PC8233TK, with dimensions of only 1.5 mm x 1.1 mm x 0.55 mm, features include low noise (0.90 dB typical), high gain of 20 dB typical and a supply voltage range from 1.6 V to 3.3V. The low current consumption of 3.5 mA typical makes the

μ PC8233TK ideally suitable for mobile navigation systems and tracking devices.

The μ PC8236T6N is a low noise amplifier in a 1.5 mm x 1.5 mm x 0.37 mm, 6-pin TSON (Thin Small Out-line Non-leaded) package. Because of its high integration density, the only external components required for this device are

four capacitors and a coil. The noise behavior of the device could be optimized to 0.8 dB. As with the μ PC8233TK, the μ PC8236T6N also operates with a supply voltage range from 1.6 V to 3.3V. Additional advantages are very low distortion and a low current



consumption of 6.5 mA typical.

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Employee profile of Carmen Epple – Gleichmann & Co. Electronics GmbH

Following her commercial education, Carmen Epple first of all gathered her sales and purchasing experience in other industries before joining Gleichmann Electronics 20 years ago.

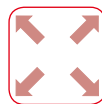
Carmen spent the first years in sales before taking over in 1990 a position in purchasing of microcontrollers from NEC Electronics and Samsung. Today, as manager of a 5 person purchasing team, she is still enthusiastically devoted to fulfilling the needs and

wishes of the customers.

In parallel to this, Carmen, as administration manager, has made a significant contribution to the establishment and expansion of Gleichmann's office in Stuttgart, which opened in 1999. With commitment and dedication, Carmen, as

training manager, looks after our commercial trainees, who profit from her comprehensive knowledge and experience.

Carmen, a passionate skier, will celebrate her 47th birthday in June with a motorbike tour from Germany to Norway.



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