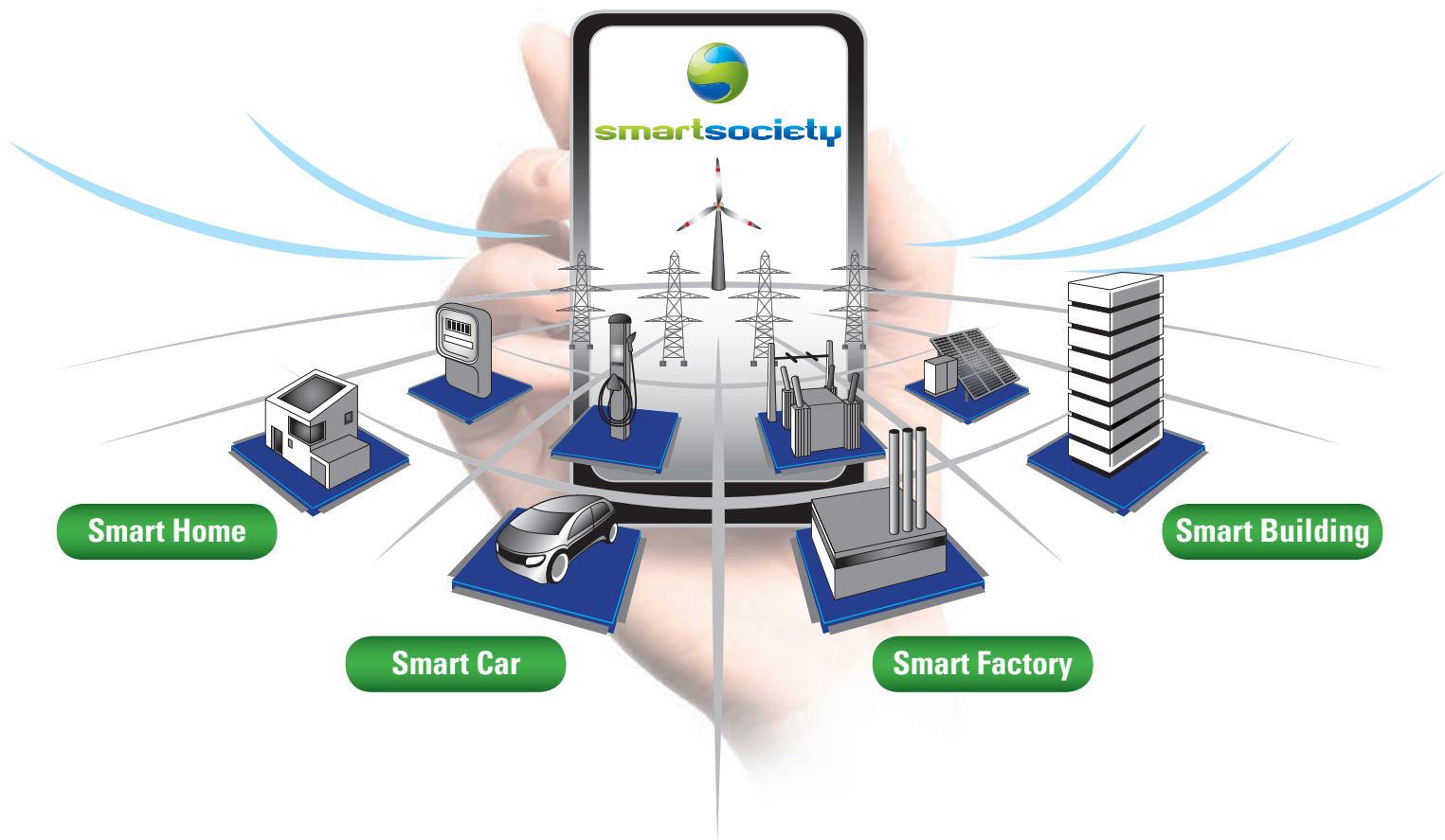


# Smart Solutions for a Smart Society



# Renesas, the Engineer's Choice

Renesas Electronics Corporation is the world's number 1 provider of advanced semiconductor solutions addressing the Smart Society. Our broad portfolio of world leading products includes microcontrollers, ASSPs, ASICs and memory devices, as well as analogue and power components to complete your solution. Combining these with convenient reference designs for targeted applications simplifies the design engineer's job and helps speed our customers' time to market. With a reputation for the highest product quality and reliability, best in class technical support and long product lifetimes, Renesas is the natural choice for design engineers in the 21st century. Interested? Then read on...



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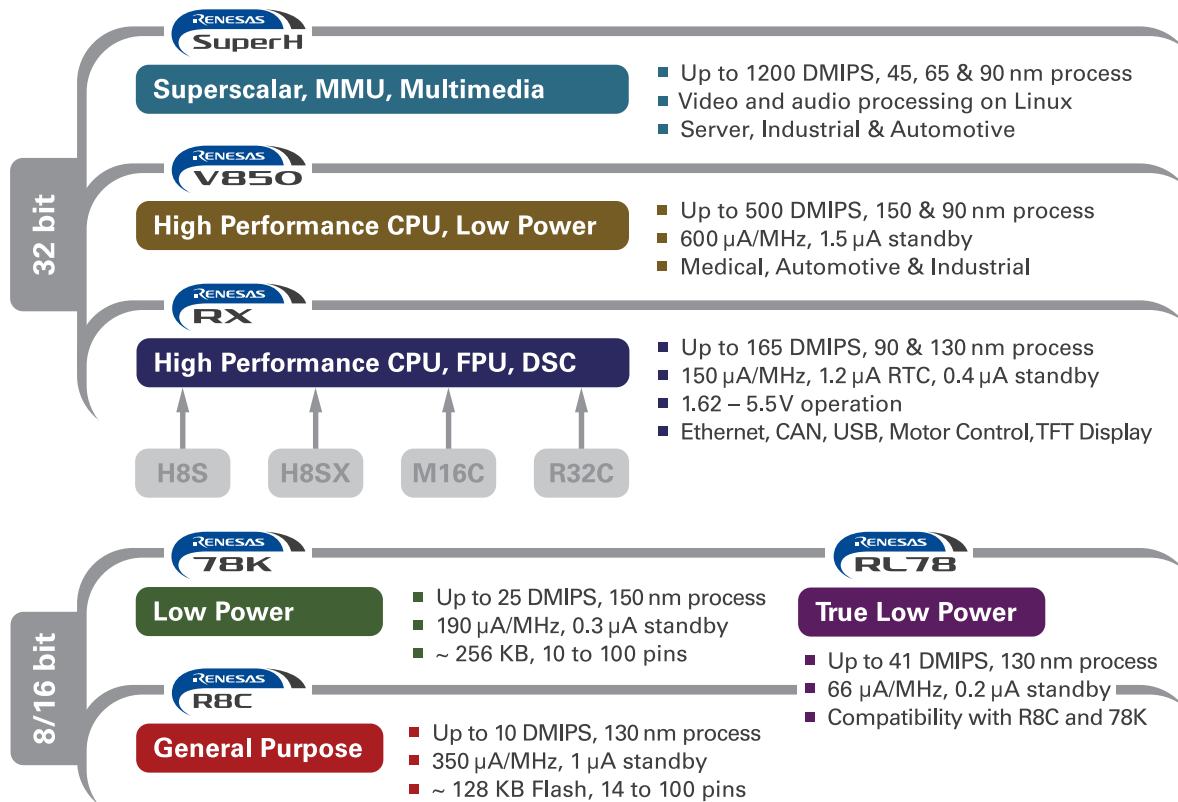
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# A Platform of Market Leading Products

The undisputed world leader in Microcontrollers



## Complete the kit – the total solution from Renesas

### Optocouplers

- Best in class isolation and shielding
- Standard, high speed, IGBT/IPM driver optocouplers



### Power MOSFETs

- > 2000 devices with  $V_{\text{DSS}}$  from 20 V to 1500 V,  $I_{\text{D}}$  up to 180 A
- Low static and switching losses, wide package range



### IGBTs

- Leading efficiency thin wafer technology; low static losses, high robustness
- 600 V to 1350 V, 10 A to 90 A, short circuit capability 10  $\mu\text{s}$ , SMD and THD packages



### Low Power SRAM

- 256 kbit to 64 Mbit,  $V_{\text{CC}}$  2.4 V to 5.5 V, speed up to 55 ns
- Lowest soft error rate in the industry

### Serial EEPROM

- 2 kbit to 1 Mbit, supply voltage 1.8 V to 5.5 V, -40° C to 105° C
- Endurance 1000 k cycles, data retention 100 years at 25° C



# Smart User Interfaces

User interfaces exist almost everywhere you imagine in the Smart Society (in Smart Phones, in Domestic Appliances, in Energy Management Systems...) and because Renesas offers such a wide choice we have given them their own dedicated section on this page. Whether you want a simple segment display controller integrated on chip, or a more complex graphical display with supporting software libraries, or high end multimedia ...in every case Renesas has the perfect fit!

## Direct Drive Segment LCD

- Choose from 35 x 8 to 48 x 8 or 52 x 4 common/segment configuration
- Only 0.6  $\mu$ A current consumption @ 3 V with RTC and LCD active
- Full evaluation kit and E1 debugger
- Free of charge e2Studio (GNU) compiler included
- Sample peripheral codes including LCD drive examples
- Order your easy to use starter kit today: YR0K5010RLS000BE



## TFT Direct Drive

- Only 5% of CPU resources consumed at 60 Hz refresh
- Renesas Starter Kit including CPU Board for the RX62N
- E1 emulator including target cable & USB cable to connect to host PC
- 4.5-inch WQVGA LCD with touch screen mounted onto a base panel
- Direct Drive LCD demo project CD
- Part Number for ordering: YLCDRSKRX62NS

## Lowest BOM cost for High End HMI

- Up to 2.5 MB of integrated SRAM – No need to buy external RAM
- Boot and run from low cost external QSPI Flash – no limitation in code size
- Hardware OpenVG Graphics accelerator on chip
- From QVGA to screens SVGA with 24-bit interface
- Camera interface for easy camera integration
- Everything you need from evaluation to MP: R0K507269S000BE



## Multimedia Solution

- Dual Cortex A9 Core @ 533 MHz = ~2600 DMIPS
- 1080 P at 30 fps video decode = FULL HD
- Easy support and development with alliance partner Emtrion
- Get started today with an Emtrion Android development kit
- Contact: sales@emtrion.com

## Touch Controls

- Single-chip solution enabling system cost optimisation
- 5 to 36 touch channels, from 32 to 80 pins
- Development kit order number: YR8C36TKIT01



# Solutions for Smart Inverters

Motor control design is so easy with Renesas microcontrollers – built on a platform of powerful RL78/G14 or RX62/63T microcontrollers, combined with professional sinusoidal control algorithms and conveniently packaged in easy to use design kits – all available ex-stock!

## MCU Inverter Application Comparison

|                        | RX62T 32-bit MCU                                       | RL78 16-bit MCU                                       |
|------------------------|--|---|
| CPU Performance        | 165 DMIPS (100 MHz)                                    | 41 DMIPs (32 MHz)                                     |
| Motor types            | PMAC, AC Induction                                     | PMAC  |
| Control technique      | Sinusoidal Field Oriented                              | Sinusoidal Field Oriented                             |
| Current measurement    | 1 or 3 shunt sensorless                                | 1 or 3 shunt sensorless                               |
| Resources used         | 9 KB Flash, 2.5 KB RAM<br>30 $\mu$ S control algorithm | 13 KB Flash, 2 KB RAM<br>86 $\mu$ S control algorithm |
| Switching frequency    | Up to 50 kHz   | Up to 24 kHz  |
| Design Kit part number | YRMCKITRX62T   | YRMCKITRL78G14  |

## Inverter Design Kit contents

- PCB with connectors, USB Cable, Demonstration 24 V PMAC Motor
- CD with all documentation and software
- Software, GUI, Motor Control Project, USB UART Drivers
- Royalty free source code, schematics, gerber files, PC GUI (see below)
- 1.5 KW power stage compatible to both kit available from third party



## Easy to use Graphical User Interface

- Display/control torque, current voltage...
- Motors parameter set up table
- Calibration of Coefficients in real-time
- Auto-tuning facility included
- E1 interface for additional debug & development

## Renesas Power devices to complete your Inverter design

- Power MOSFET – from 20 V to 1500 V, 0.1 A to 180 A
- IGBT – from  $V_{ces} = 600$  V to 1350 V,  $I_c = 10$  A to 90 A, tsc up to 10  $\mu$ s
- Wide package line up including: DPAK, SOP-8, SOT-223, TO-92, TO-263, TO-220, TO-3P, TO-247 as well as higher performance packages and isolated/non-isolated types
- For full information including data sheets, cross references, example applications, evaluation boards and spice parameters, visit: [www.renesas.eu/products/index.jsp](http://www.renesas.eu/products/index.jsp) and select “Power MOSFETs” or “IGBT”



# Smart Energy Solutions



Renesas' Smart Energy solutions embody the principles of efficiency, intelligence and security, whether applied to green power generation, energy measurement, control and management, or related communications technologies (see page 8 for further details).

## RX21A Metrology SoC

- Full hardware & software reference platform
- Based on performance RX microcontroller with precision 24-bit A/D's
- Contact Renesas for full reference design files



## Gas Meter Reference Design

- Complete hardware & software design
- Based on market-leading low power RL78 microcontroller
- Contact Renesas for full reference design files



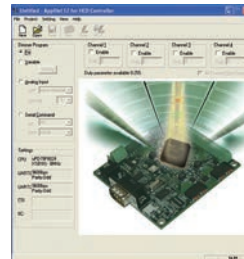
## RX62T Grid-Tied Solar Inverter

- Complete MPPT system hardware & software design
- Based on Renesas RX62T, optocouplers, IGBT's & MOSFET's
- Contact Renesas for full reference design files



## RL78/I1A DC-DC LED Demonstration Kit

- Multi-channel precision PWM dimming with multiple interfaces
- Complete with easy-to-use lighting design GUI software
- Order Y-RL78DCDC-LED today



## PFC-LED Drive IC Retrofit Bulb Solutions

- Industry leading Power Factor, efficiency & BOM cost
- Versions for isolated/non-isolated & dimming/non-dimming
- Contact Renesas for availability of evaluation boards



## Participation in industry standards

Renesas actively participates in a number of industry standards bodies and associated working groups dedicated to the specification of local smartgrid projects and proof of concept trials. These include:



# Smart Factory Solutions



Renesas' Smart Factory solutions embed latest standards and trends into silicon following our strategy to build differentiating devices to help our customers to gain easy and efficient access to latest technologies in industrial networks, drives, controls and sensors. Our long term available solutions and local expertise make us the ideal industrial partner to our many customers in Smart Factory segment.

## PROFINET made easy – TPS-1P Starter Kit

- Complete Profinet connection with stack and integrated
- Switch controller; additional V850 for application software (examples contained)
  - extendable with any MCU RSK

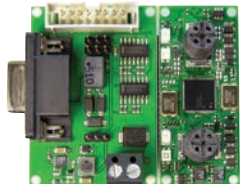
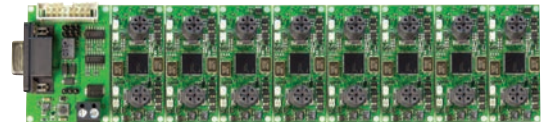


## Ethernet PHY Starter kits

- Single and dual channel starter kits
- Contain PHY device with large number of interface options
- Standard MII to uplink controller

## Remote-IO Toolbox

- Build your own remote-IO based on a reference design
- Contains sensor connection based on IO-Link including stack
- Uplink Ethernet stack for Profinet and Ethernet IP and related
- Header board



## IO-Link Master Starter Kit

- World's first integrated 2channel IO-Link Master controller
- Easy interface to uplink Ethernet
- Contains IO-Link stack V1.1 and uplink driver software

## IO-Link Slave Starter Kit

- Easy to adopt solution for new sensor interface protocol
- Contains integrated single chip IO-Link device controller and stack software IO Link V1.1 plus a demo temperature sensor



## Active Member in Standards Groups

Renesas is active member in Profinet, IO-Link, ODVA, SerCos and EtherCAT as well as participating in several working groups for safety and security.



# Smart Communications



As a pioneer in the ZigBee™ Alliance, an active member of the major Powerline standardisation groups, board member of DALI AG and implementer of most major wired and wireless communications protocols, Renesas, together with its Alliance Partners, is at the forefront of advanced silicon platforms and software solutions that make smart systems “smart.”

## Powerline Communications

- Single platform support for multiple OFDM protocols
- Contact Renesas for OFDM PLC information
- World’s most robust PLC using DCSK solution
- Visit [bit.ly/UaF0mj](http://bit.ly/UaF0mj) for DCSK PLC solution



## Wi-Fi solutions

- Wi-Fi modules integrating baseband, radio, PA & antenna
- Easy connection to any Renesas MCU through SPI or UART
- Ordering: [www.redpinesignals.com](http://www.redpinesignals.com) [www.gainspan.com](http://www.gainspan.com)



## Lighting Communications Demonstration Kit

- Supports DALI, DMX512 & infrared communications
- Includes PC-based DALI & DMX512 GUI tools
- Order Y-78K0-LIGHTCOMM now

## KNX Communications Stack

- Building communications protocol
- Certified stack for RL78
- Contact Renesas for further information



## Wireless M-Bus Solutions

- Embedded & modular solutions based on AMiHo & Steinbeis stacks
- Supports Semtech & Analog Devices 2.4 GHz & < 1 GHz transceivers
- Contact Renesas for further information

## ZigBee™ Wireless Communications

- Complete ZigBee™ solution including:
- ZigBee™ Pro stack, SE or HA profile, ZigBee™ Modules
- For further information or to order your own design kit contact our Alliance partner AND TR





# Real Time Operating Systems

With industry leading levels of CPU performance in addition to vast amounts of integrated Flash and RAM Renesas microcontrollers are well suited to demanding embedded applications. As these applications become ever more complex an increasing number of engineers are looking at realtime operating systems (RTOS) and the benefits they bring to address the demanding requirements of these modern applications.



A modern RTOS ensures that the most important part of an application, or task, always runs first resulting in fast and responsive systems. Breaking an application down into tasks simplifies system design, speeds up development and reduces debugging time.



An RTOS provides many services to the developer including those associated with time in the form of delays, timeouts and software timers. With a system broken down into tasks an RTOS provides functionality for these tasks to communicate and share data via semaphores, mutexes, queues and mailboxes. Memory management is also typically provided eliminating fragmentation often suffered by embedded systems. Additionally an RTOS may provide features for measuring the performance of a system such as CPU loading, response times and stack usage, valuable assets in an engineers software toolbox.

Along with providing an RTOS solution a typical vendor will also be able to offer a compliment of other tools including communication stacks such as TCP/IP and USB along with file systems, web servers and graphical user interfaces to name but a few.

Being a market leading provider of microcontroller solutions Renesas works in close partnership with the top RTOS third parties. Working so closely means that Renesas micros are supported by the RTOS vendors on launch and these RTOS's make use of the powerful features of the microcontrollers such as register banking ISRs to ensure the maximum efficiency and performance is achieved. All of our RTOS partners offer world class levels of technical support when required.

For further information and to discuss your needs please contact your local Renesas representative or the RTOS vendors directly.

## Other RTOS available on Renesas MCUs



[www.freertos.org](http://www.freertos.org)



[www.mentor.com](http://www.mentor.com)



[www.micrium.com](http://www.micrium.com)



[www.euros-embedded.com](http://www.euros-embedded.com)



[www.rtos.com](http://www.rtos.com)



[www.qnx.com](http://www.qnx.com)



[www.segger.com](http://www.segger.com)



[www.cmx.com](http://www.cmx.com)

# Renesas Alliance Partners

The **Renesas Global Alliance Program** combines Renesas' advanced microcontroller products with the know how and expertise of our Alliance partners. It facilitates the development of outstanding embedded solutions and fast time to market for Renesas' customers. In total there are over 700 Renesas Alliance partners worldwide – the largest such network in the industry.



**Platinum Partners** status is available only to premium Renesas partners with deep knowledge of Renesas devices and tools and who have achieved significant success over many years in serving customers with developing embedded systems. The existing companies qualifying for this prestigious recognition are shown in the panel on the right.



**Gold Partners** are design consultants that are known to Renesas and which have design experience with Renesas products leading to manufacturing. They would normally employ at least five or more design engineers or software programmers full time.

To find a Renesas Alliance partner near you, visit our dedicated Alliance website at <https://secure-alliance.renesas.com/eu/index.jsp> where you will find full parametric search functionality enabling you to choose not only the right support, but also to find much needed expertise located close to your own offices. With the industry's largest 3rd party support network of more than 700 specialists, you can be sure of finding the perfect fit once more.

## MCU Software Libraries

In order to simplify customer's designs and to help speed your time to market, Renesas offers a wealth of ready to use sample software for download at [www.renesas.eu](http://www.renesas.eu) (look under Support/Design tab). These reference programs illustrate the use of MCU peripheral functions and functions that are commonly required when actually using the MCU, as well as more complex application building blocks such as motor control algorithms and others. They are mainly provided in the form of source code.

- Drivers, Stacks, Middleware and more
- Over 2000 software routines
- Download free of charge! (Registration on My Renesas required)

## DSP Libraries also online...

- 36 Kernels, 308 functions available
- Speed your development!
- Simplify debug!

The Renesas DSP library supports rich data type combinations of input and output, fine-grained options for truncation, saturation and more. Of course, these are also fully optimized in assembly code for execution speed to extract the best from the RX microcontroller. Therefore, you can start to add DSP features to your system now!

## For further information...



Renesas on the Web  
[www.renesas.eu](http://www.renesas.eu)



Online technical training  
[www.renesasinteractive.com](http://www.renesasinteractive.com)



*Think it. Build it. Post it.*  
Engineering community  
[www.renesasrulz.com](http://www.renesasrulz.com)



Facebook group  
[www.facebook.com/renesaseurope](http://www.facebook.com/renesaseurope)



3rd Party network  
[www.renesas.eu/alliance](http://www.renesas.eu/alliance)



Twitter news feed  
[www.twitter.com/renesas\\_europe](http://www.twitter.com/renesas_europe)



Personalised news & services  
[www.renesas.eu/myrenesas](http://www.renesas.eu/myrenesas)



RenesasPresents video channel  
[www.youtube.com/RenesasPresents](http://www.youtube.com/RenesasPresents)

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Before purchasing or using any Renesas Electronics products listed herein, please refer to the latest product manual and/or data sheet in advance.

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