Renesas Electronics’ RL78/I1B microcontroller family delivers a genuine single-chip solution for electricity measurements in applications such as single or multi-load energy monitoring. The software defined metrology architecture offers a highly flexible methodology that can be adapted to many varied industrial and consumer applications both within and outside of the traditional 50/60Hz power measurement arena, whilst high accuracy and a wide range of peripherals, including segment LCD direct drive and flexible serial communications, make the RL78/I1B family an ideal fit for any non-billing single-phase application. The RL78/I1B is supported by a complete suite of tools including software, debugger, and an energy monitor evaluation platform that allows performance tests to be conducted.

**Applications**
- Non-billing electricity meters (sub-metering)
- Industrial metering
- Appliance monitoring
- Single-phase home energy monitors
- Multi-outlet power distribution unit monitors
- UPS/generator power output monitoring

**Key Benefits**
- Full single-chip solution including direct segment LCD drive
- Up to four independent 24-bit ΔΣADC channels, each with its own PGA
- Full energy monitor reference design provided
  - Windows™ GUI connects to reference design
  - Accuracy to EN50470 class B (1%). Reference design rated to 16 A
  - Tested metrology software provided in source code

**RL78/I1B Block Diagram**

**Analog**
- 24-bit ΔΣ ADC 4 ch
- Internal VREF
- Temp. Sensor
- 8/10-bit SAR ADC 6 ch
- Comparator 2 ch

**RL78 16-bit CPU**
- 24 MHz 33 DMIPS
- CISC Harvard Architecture 3-stage Pipeline
- Four Register Banks
- 16-bit Barrel Shifter
- MUL/DIV/MAC

**Timers**
- Timer Array Unit 16-bit 8 ch
- Interval Timer 12-bit x 1 ch, 8-bit x 4 ch
- WDT 17-bit, 1 ch
- High Accuracy RTC

**Communication**
- 1 x I²C Multi-Master
- 1 x UART/CSI/ Simple I²C
- 1 x UART/ Simple I²C
- 1 x UART/ IrDA

**Memory**
- Program Flash 64 KB, 128 KB
- SRAM 6 KB, 8 KB

**Safety**
- RAM Parity Check
- ADC Self-diagnostic
- Clock Monitoring
- Memory CRC
- RAM/SFR Guard
- Oscillation STOP Detector

**Power Management**
- HALT
- SNOOZE Serial, ADC enabled
- STOP SRAM On

**System**
- DTC
- Interrupt Controller 34 int., 10 ext.
- Clock Generation Internal, External
- HOCO Clock Freq. Correction
- Battery Backup Function
- POR, LVD
- MUL/DIV/MAC
- Debug Single-Wire

**LCD**
- Int. Voltage Boost
- Capacitive Split

**System**
RL78/I1B – The Single-phase Electricity Meter Microcontroller

Key Features

Ultra low power 16-bit RL78 CPU core

- 24 MHz operating frequency
- High Accuracy +/-1% High-Speed On-chip oscillator with clock frequency correction function

Memory Line-up

- 64 Kbytes and 128 Kbytes Flash
- 6 K bytes and 8 Kbytes SRAM

Low-power design and architecture

- 1.9 to 5.5 V operation
- 70 μA/MHz operation current.
- 0.7 μA (RTC + LVD) standby current.
- Standby function: HALT, STOP, SNOOZE mode

Optimized System & Peripherals

- System
  » Power On Reset (POR), Low Voltage Detection (LVD)
  » Battery backup function
  » Debug function
  » Data Transfer Controller (DTC)
  » Clock output/buzzer output controller
- Real-time clock
  » 1 channel with high accuracy 1 Hz output function
- General Purpose Timers
  » 8 channel 16-bit timer TAU, 1 channel 12-bit interval timer, 4 channels 8-bit interval timer, 1 channel oscillation stop detection circuit

Ordering Information

<table>
<thead>
<tr>
<th>Pin Count</th>
<th>Flash ROM</th>
<th>RAM</th>
<th>Package</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-pin</td>
<td>128 K</td>
<td>8 K</td>
<td>100-pin plastic LQFP (14 × 14 mm, 0.5 mm pitch)</td>
<td>R5F10MPGDFB</td>
</tr>
<tr>
<td>80-pin</td>
<td>128 K</td>
<td>8 K</td>
<td>80-pin plastic LQFP (12 × 12 mm, 0.5 mm pitch)</td>
<td>R5F10MMGDFB</td>
</tr>
<tr>
<td>100-pin</td>
<td>64 K</td>
<td>6 K</td>
<td>100-pin plastic LQFP (14 × 14 mm, 0.5 mm pitch)</td>
<td>R5F10MPEDFB</td>
</tr>
<tr>
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<td>6 K</td>
<td>80-pin plastic LQFP (12 × 12 mm, 0.5 mm pitch)</td>
<td>R5F10MMEDFB</td>
</tr>
</tbody>
</table>

- Watchdog Timer
  » 1 channel, operable with the dedicated low-speed on-chip oscillator
- Communications
  » 1 channel CSI/UART (LIN-bus supported/simplified I²C, 1 channel UART/simplified I²C, 1 channel UART/IrDA
- Analog functions
  » 2.4 to 5.5 V operation
  » Up to four independent 24-bit ΔΣADC channels, each with its own PGA
  » Up to 80dB SINAD
  » Voltage reference with typ. 30 ppm/°C temp coefficient
  » Up to 6 channels 10-bit ADC
  » On-chip comparator
- LCD Controller
  » Segment output 34 (30) or 42 (38)
  » Common signal output 4 (8)

Operating temperature range

- -40°C to +85°C

Package line-up

- 80-pin and 100-pin

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