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## **Household Water Pump**

### Overview

This household water pump reference design includes microcontrollers (MCUs), photocouplers, comparators, and gate drivers. Comparators compare and amplify signal data from water-level sensors. The RL78/G13 is a 16bit MCU that is ideal for system control and controlling an LCD. Photocouplers and gate drivers prevent high voltages from affecting the system. They receive the signal and provide high efficiency for motor driving control.

### System Benefits

- This system provides low power consumption and low noise for the water pump
- Renesas' photocoupler and gate driver combined with an inverter provide high efficiency
- This system features solutions that are compact, provide high efficiency, and are environment friendly



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## **Household Water Pump**





## **Household Water Pump**

Device Category	P/N	Key Features		
MCU	RL78/G13	Standard functions MCU. Low power and abundant lineup for general purpose applications.		
Power	ISL8117	Synchronous step-down DC/DC controller. 60V synchronous step-down PWM DC/DC controller with wide Vin & Vout range.		
	ISL80410	High voltage adjustable VOUT LDO. Low quiescent current and 40V/150mA output.		
Analog	UPC271G2	High performance comparator. Suitable for low voltage, low power consumption and fast response.		
	HIP4086/A	80V, 500mA, 3-Phase MOSFET driver. 3-phase N-channel MOSFET drivers targeted for PWM motor control.		

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# **RL78/G13 – Standard Functions MCU**

### Low Power and Abundant Lineup for General Purpose Applications High Performance Peripheral Functions

- 43.2 DMIPS (32 MHz)
- On-chip oscillator, data flash, 10-bit A/D converter
- Built-in safety features enable support for the household appliance safety standard (IEC/UL 60730)

#### Low Power

- CPU: 66 µA/MHz, standby (STOP): 230 nA
- 0.57 µA (RTC\_LVD,HALT mode)

### Abundant Lineup

- 16-512KB ROM / 2-32KB RAM
- 20-128 pin package

Part #	Flash ROM	RAM	Package(mm)
R5F1006/7/8x R5F1016/7/8x	16 ~ 64 KB	2 ~ 4 KB	20-LSSOP,24-HWQFN(4 x 4),25-WFLGA(3 x 3)
R5F100A/B/Cx R5F101A/B/Cx	16 ~ 128 KB	2 ~ 12 KB	20-LSSOP,32-HWQFN(5 x 5), 36-WFLGA(4 x 4)
R5F100Ex R5F101Ex	16 ~ 192 KB	2 ~ 16 KB	40-HWQFN(6 × 6)
R5F100F/Gx R5F101F/Gx	16 ~ 512 KB	2 ~ 32 KB	44-LQFP(10 × 10), 48-LFQFP(7 × 7), 48-HWQFN(7 × 7)
R5F100J/Lx R5F101J/Lx	32 ~ 512 KB	2 ~ 32 KB	52-LQFP(10 × 10), 64-LQFP(12 × 12), 64-LFQFP(10 × 10), 64-VFBGA(4 × 4),
R5F100M/Px R5F101M/Px	96 ~ 512 KB	8 ~ 32 KB	80-LQFP(14 × 14), 80-LFQFP(12 × 12), 100-LQFP(14 × 20), 100-LFQFP(14 × 14),
R5F100Sx R5F101Sx	192 ~ 512 KB	16 ~ 32 KB	128-LFQFP(14 × 20)



#### **BOM Cost Reduction Use Case**



Renesas Starter Kit for RL78/G13



QB-R5F100LE-TB Easy Evaluation Kit

### ISL8117 – Synchronous Step-Down DC/DC Controller 60V Synchronous Step-Down PWM DC/DC Controller with Wide Vin & Vout Range

### Easy to Use

 Low pin count, fewer external components, and default internal values makes the ISL8117 an ideal solution for quick-to-market power supply designs

### Wide Working Range

- Wide input voltage range: 4.5V to 60V
- Wide output voltage range: 0.6V to 54V

### System Safe Design

- Programmable soft-start
- Supports pre-biased output at startup
- Adaptive shoot-through protection prevents MOSFET damage
- Complete protection: Overcurrent, overvoltage, over-temperature, undervoltage

Part #	#of output	Vin Range (V)	lout (max)(A)	Vout Range (V)	Package
ISL8117FRZ	1	4.5-60	30	0.6-54	16Ld 4x4 DFN
ISL8117FVEZ	1	4.5-60	30	0.6-54	16Ld HTSSOP







ISL80019xEVAL1Z Evaluation Board

# ISL80410 – High Voltage Adjustable V<sub>OUT</sub> LDO

Low Quiescent Current and 40V/150mA Output

### High Performance and Wide Input Range

- Wide V<sub>IN</sub> range of 6V to 40V
- Adjustable output voltage from 2.5V to 12V
- Ensured 150mA output current
- ±1% accurate voltage reference (over temperature, load)

### **High Efficiency**

- Ultra low 18µA typical quiescent current
- Low 2µA of typical shutdown current
- Low dropout voltage of 295mV at 150mA
- Low 26µVRMS noise

### **Excellent Safety**

- 40V tolerant logic level (TTL/CMOS) enable input
- 5kV ESD HBM rated
- Thermal shutdown and current limit protection

Part #	V <sub>IN</sub> Range(V)	V <sub>out</sub> Range(V)	Enable Pin	Package
ISL80410IBEZ	6 to 40	ADJ	Yes	8 Ld EPSOIC
ISL80410IBEZ-T	6 to 40	ADJ	Yes	8 Ld EPSOIC
ISL80410IBEZ-T7A	6 to 40	ADJ	Yes	8 Ld EPSOIC



**Typical Application Circuit** 



ISL80410EVAL1Z Evaluation Board

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# HIP4086/A – 80V, 500mA, 3-Phase MOSFET Driver

**3-phase N-channel MOSFET Drivers Targeted for PWM Motor Control** 

### **High Performance and Efficiency**

- Independently drives 6 N-channel MOSFETs in 3-phase bridge configuration
- Bootstrap supply maximum voltage up to 95VDC with bias supply from 7V to 15V
- 1.25A peak turn-off current

#### **High Frequency**

- User programmable dead time (0.5µs to 4.5µs)
- Drives 1000pF load with typical rise time of 20ns and fall time of 10ns

### Flexible Usage

- Bootstrap and optional charge pump maintain the high-side driver bias voltage.
- Programmable bootstrap refresh time
- Programmable undervoltage set point

Part #	Charge Pump	Package
HIP4086ABZ	Yes	24 LD SOIC
HIP4086APZ	Yes	24 LD PDIP
HIP4086AABZ	No	24 LD SOIC









HIP4086DEMO1Z Demo Board

**Charge Pump Output Current** 



# µPC271/311 – High Performance Comparator

Suitable for Low Voltage, Low Power Consumption and Fast Response

### **High Performance**

- Input Offset Voltage ±2 mV (TYP.)
- Input Bias Current 100 nA (TYP.)
- Pulse Response Time 200 ns (TYP.)
- Large output current capacity to directly drive the LEDs and lamps

### Flexible Usage

- Equipped with a Strobe Terminal, ideal for interfacing with logic circuits.
- Two output circuit formats are possible (open collector, emitter follower)
- Power supply voltage range is flexible whereby it exhibits excellent characteristics not only in a 5V single power supply but also in ± 15 V power supply

Part #	Temp Range (°C)	Package
µPC271G2-A	-40 to +85	8-pin plastic SOP ( 5.72 mm )
µPC311G2-A	-20 to +80	8-pin plastic SOP ( 5.72 mm )



**Application Circuit Example** 



#### **Pulse Response Characteristics I**





