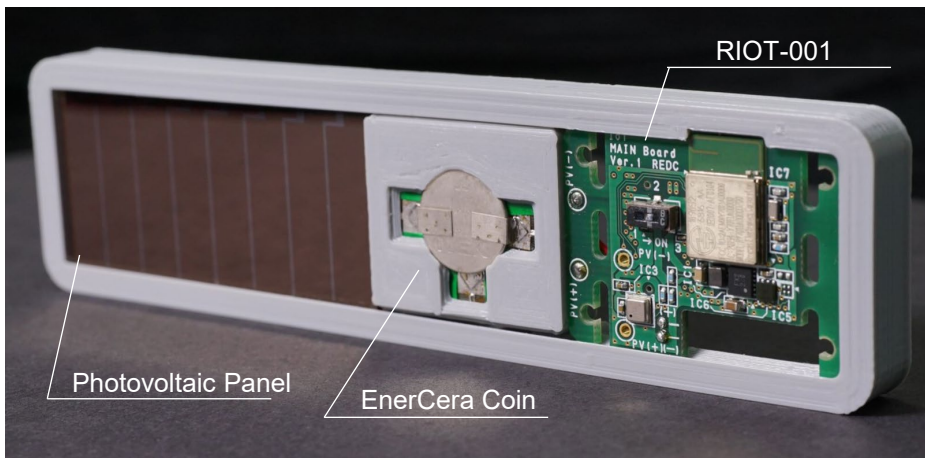
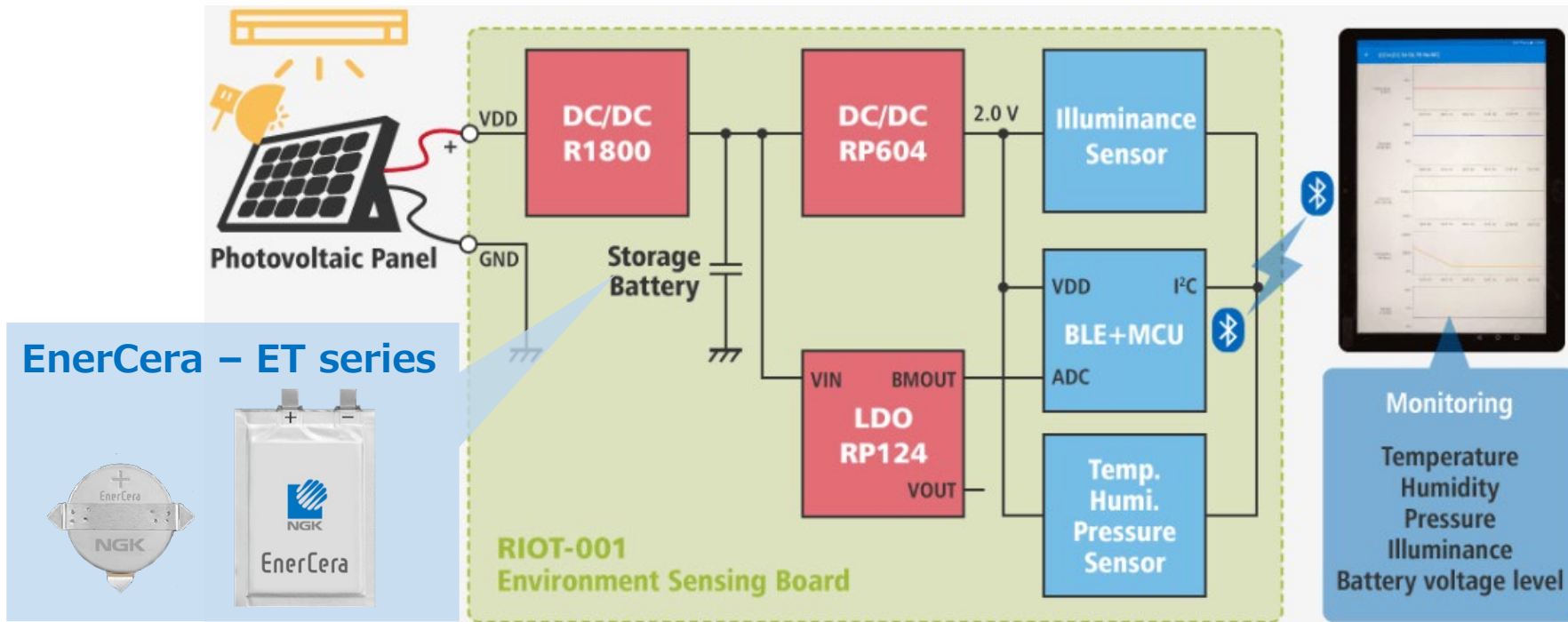


# Maintenance-free Environment Sensor with EnerCera

# Maintenance-free Environment Sensing Demo-Board

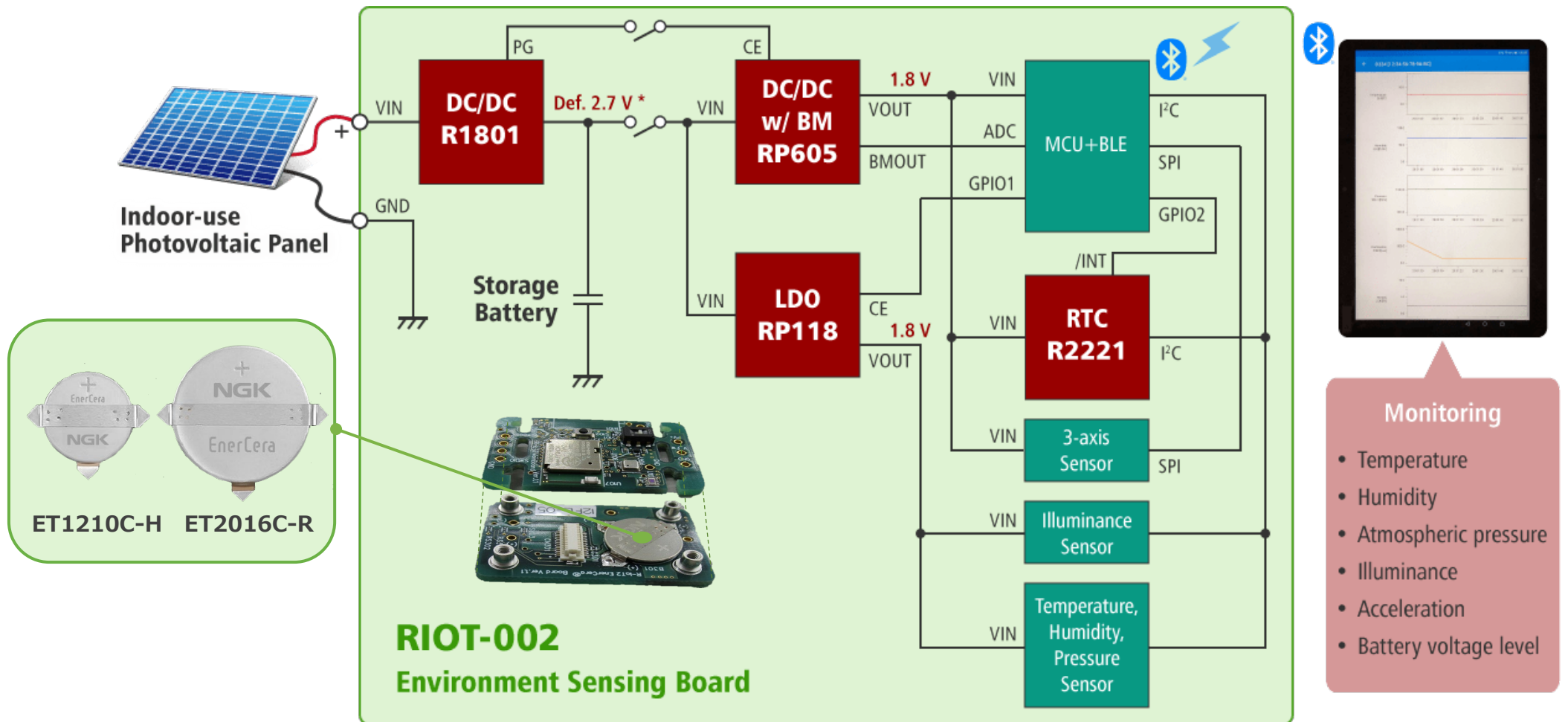
RIOT-001+EnerCera®



- ✓ Charging from Photovoltaic Panel to Secondary Battery
- ✓ High-efficiency Operation
- ✓ Battery Monitoring with Low Power Consumption
- ✓ Maintenance-free Operation

# Maintenance-free Environment Sensing Demo-Board

RIOT-002+EnerCera®



\*) The output voltage of the R1801 can be changed between 2.5 V and 2.8 V. Please contact us for details.

The RIOT-002 is an environment sensing board which monitors ambient temperature, humidity, atmospheric pressure, illuminance, and acceleration. The information it transmits with its Bluetooth Low Energy (BLE) can be displayed on smartphones or tablets where an application programmed for it is installed. The following items can be customized by using a dedicated application

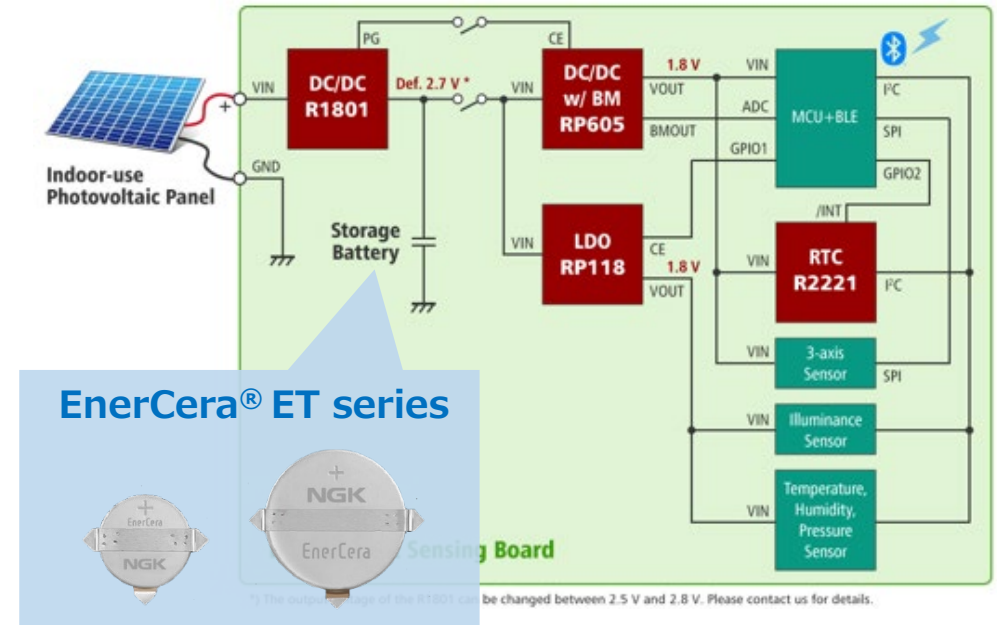
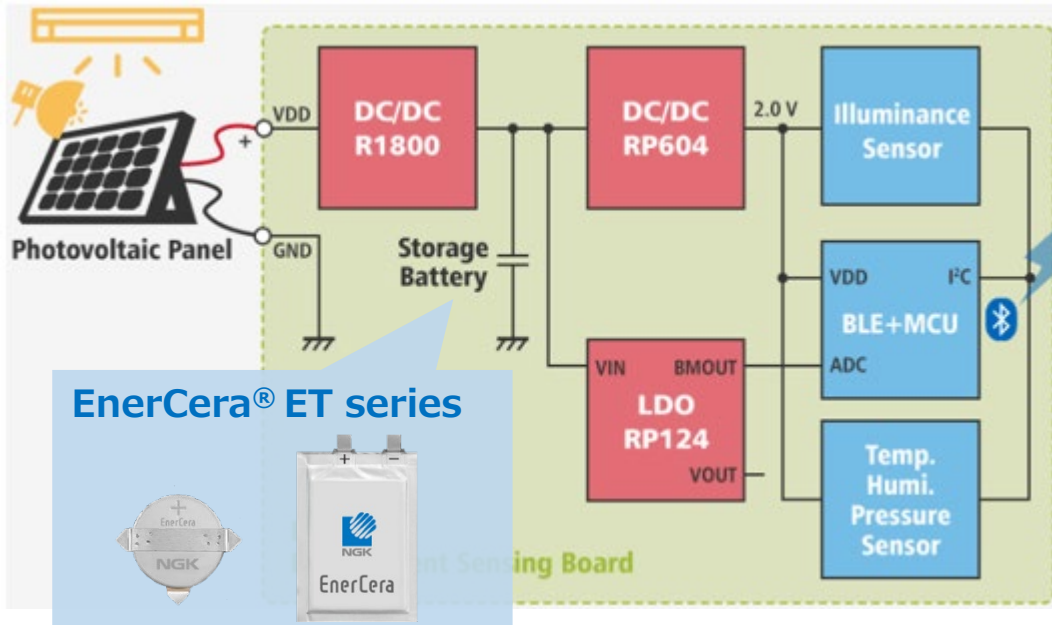
**Monitoring**

- Temperature
- Humidity
- Atmospheric pressure
- Illuminance
- Acceleration
- Battery voltage level

<https://www.nisshinbo-microdevices.co.jp/en/applications/iot-module/environment-sensor/riot-002.html>

# Maintenance-free Environment Sensing Demo-Board

RIOT-001+EnerCera®



Nisshinbo Micro Devices Company provides various power management ICs which are suitable for IOT terminals such as maintenance-free Environment Sensing boards.

According to the application and purposes, select appropriate devices .

### Energy Harvesting Discrete ICs

PN	Type	Photovoltaic
<b>R1800</b>	Buck	☉ Multi-cell
<b>R1801</b>	Buck	☉ Multi-cell
<b>R1810</b>	Boost	☉ <b>1cell</b>

### Ultra Low Iq Discrete ICs

PN	Type	PN	Type
<b>RP118</b>	LDO	<b>RP124</b>	LDO + BM
<b>RP511</b> <b>RP512</b>	Buck	<b>RP514</b> <b>RP515</b>	Buck + BM
<b>RP516</b> <b>RP517</b>	Buck	<b>RP605</b>	Buck/Boost + BM
<b>RP604</b>	Buck/Boost		

### Low noise LDO

PN
<b>RP122</b> <b>RP123</b>

# PMICs that support for Maintenance-free IoT devices

Energy Harvesting  
Discrete ICs

PN	Type	Photovoltaic	Vibration w/ ACDC	Operating Voltage	MPPC internally fixed	Vset	Iq
<b>R1800</b>	Buck	☉ Multi-cell	○	2.0~5.5V	2.0~5.3V 0.1V step	2.0~4.5V 0.1V step	<b>144nA</b>
<b>R1801</b>	Buck	☉ Multi-cell	○	2.2~5.5V	2.2~5.3V <b>Limited adjustment by logic pins</b>	2.2~4.5V	<b>200nA</b>
<b>R1810</b>	Boost	☉ <b>1cell</b>	○	<b>0.35~2.1V</b>	<b>0.2~2.1V</b> 50mV step	2.0~4.5V 0.1V step	<b>600nA</b>

Ultra Low Iq Discrete ICs  
+ Battery Monitor supporting

PN	Type	Iq	Iout	Vin	Vout
<b>RP118</b>	LDO	<b>0.2uA</b>	100mA	1.7V-5.5V	1.2V-3.6V
<b>RP511</b> <b>RP512</b>	Buck	<b>0.3uA</b>	100mA 300mA	2.0V-5.5V	1.0V-4.0V
<b>RP516</b> <b>RP517</b>	Buck	<b>0.3uA</b>	100mA 300mA	1.8V-5.5V	0.3V-1.2V
<b>RP604</b>	Buck/Boost	<b>0.3uA</b>	300mA(Buck)	1.8V-5.5V	1.6V-5.2V
<b>RP124</b>	LDO + BM	<b>0.2uA</b> <b>+ 0.1uA</b>	100mA	1.7V-5.5V	LDO : 1.2V-3.6V BM : 1/3, 1/4
<b>RP514</b> <b>RP515</b>	Buck + BM	<b>0.3uA</b> <b>+ 0.1uA</b>	100mA 300mA	1.8V-5.5V	Buck : 1.0V-4.0V BM : 1/3, 1/4
<b>RP605</b>	Buck/Boost + BM	<b>0.3uA</b> <b>+ 0.1uA</b>	300mA(Buck)	1.8V-5.5V	1.6V-5.2V BM : 1/3, 1/4

Low noise  
LDO

PN	Iq	Iout	en	PSRR (1k, 100kHz)	Vin	Vout
<b>RP122</b> <b>RP123</b>	10uA	400mA 250mA	<b>8uVrms</b>	<b>90dB, 65dB</b>	1.9V-5.5V	1.2V-4.8V

# PMICs that support for Maintenance-free IoT devices



## Technical Tips for Micro Power Generation/Energy Harvest/Maintenance-free IoT devices

### Energy Harvesting Discrete ICs

Solar cells are applicable for relatively dim place



“Low start-up Power” solves this issue. At low luminance environment such as indoor places, energy harvest with high efficiency is possible.

	R1800	R1801	R1810
Photovoltaic (Indoor)	Multi-cell	Multi-cell	1-2cell
I <sub>q</sub>	144nA	200nA	600nA
Minimum starting power	0.72μW @Vin 4.0V Vset 3.3V	1μW @Vin 4.0V Vset 3.0V	9μW @Vin 0.5V, Vset 2.6V

From 16 Lx, energy storage is possible※

※Photovoltaic-Indoor AM1801 (Panasonic Solar Amorton Co., Ltd. )  
[https://youtu.be/\\_vdZiFDPkPs](https://youtu.be/_vdZiFDPkPs)

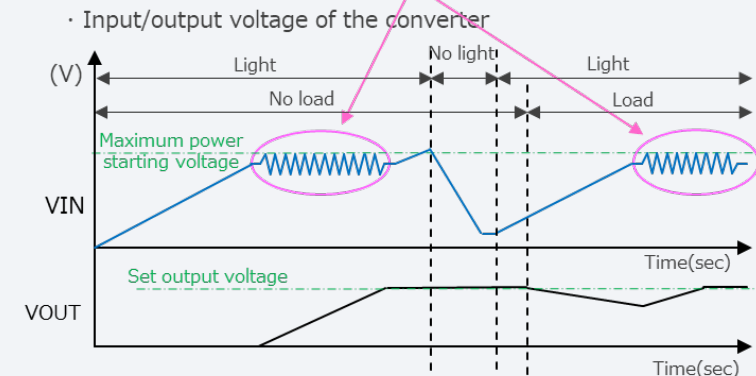
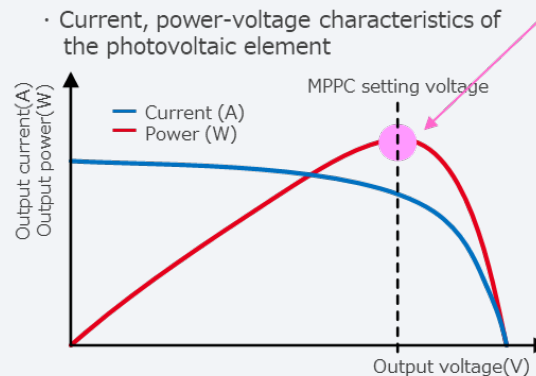
### Energy Harvesting Discrete ICs

Solar cells have 「Maximum Power Point」



“Maximum Power Point Control” solves this issue. At maximum power point, energy harvesting from solar cells becomes active and high efficiency energy harvesting is possible.

Maximum power method operates a converter at the pink point in the figure so that the output power of the photovoltaic cell is maximized.



Maximum power method achieves **low power consumption and size saving** while maximizing the power of the photovoltaic cell.

# PMICs that support for Maintenance-free IoT devices

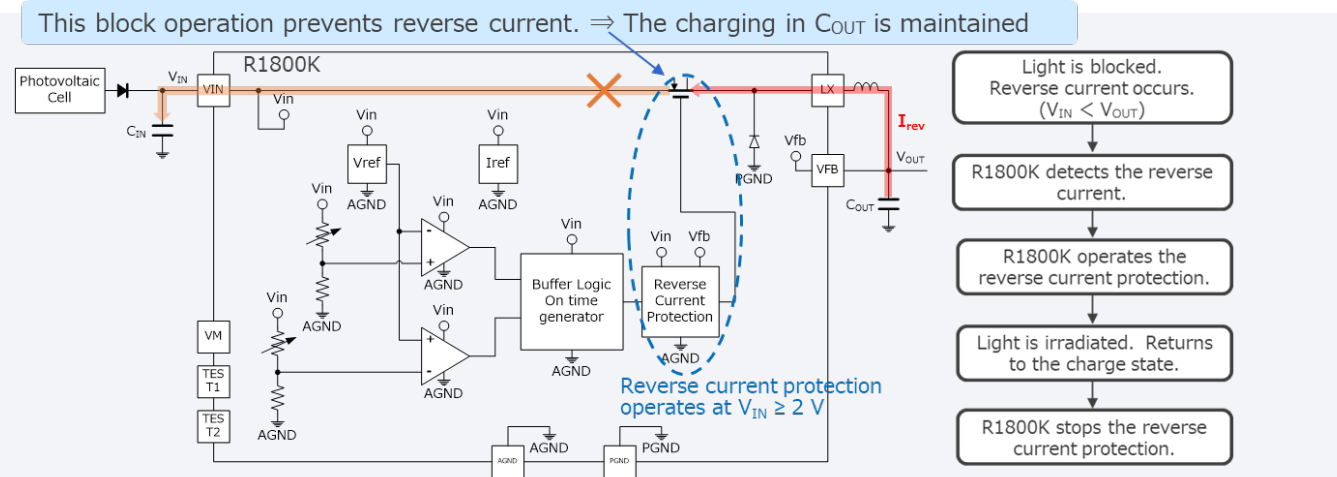


## Technical Tips for Micro Power Generation/Energy Harvest/Maintenance-free IoT devices

### Energy Harvesting Discrete ICs

When turning lights off, Solar cell cannot generate any power, and reverse current from storage devices may exist.

↓  
 “Reverse Current Protection” Function saves the storage power.

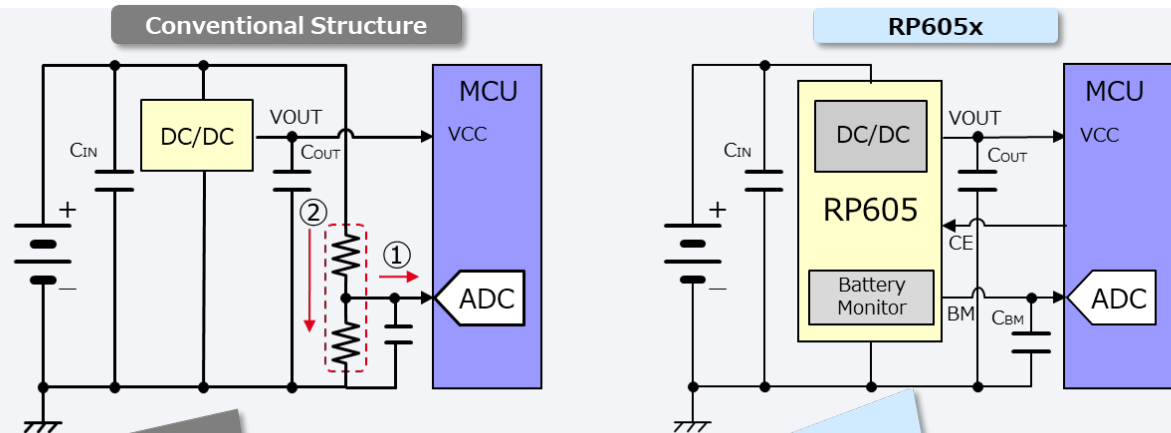


Reverse Current Protection helps stable operation and high efficiency operation of the System

### Ultra Low Iq Discrete ICs

Storage voltage level monitoring is required, measurement tolerance × low consumption current × space saving, well-balanced design is the target.

↓  
 “Battery Monitor Function” solves this issue. Input voltage is divided and buffered. The number of components is reduced and space saving.



Highly accurate measurement with a built-in ADC requires dividing resistance of battery voltage ② to be smaller than input impedance of ADC ①. However, the path structure generates large leakage current, which increases supply current of the system.

Problem is solved by dividing the input voltage with high resistance and high precision inside the IC and outputting buffered voltage. Buffer unit is designed for low power consumption.

Ultra low Iq (0.1uA) & Space Saving

# PMICs that support for Maintenance-free IoT devices



## Technical Tips for Micro Power Generation/Energy Harvest/Maintenance-free IoT devices

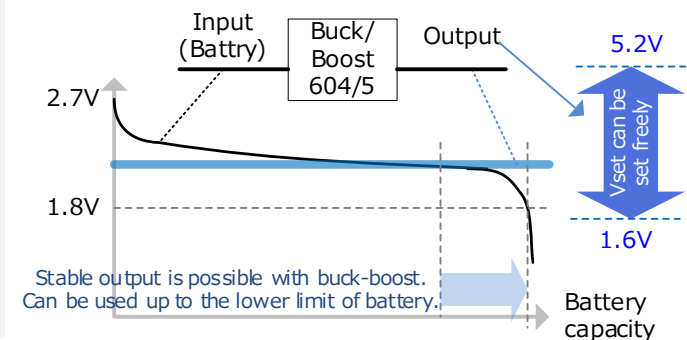
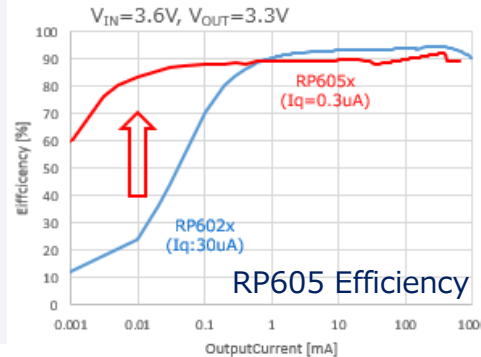
### Ultra Low Iq Discrete ICs

Storage energy should consume efficiently.



"0.5uA or less operating consumption current of IC itself solves this issue. Ultra Low Consumption current with high efficiency, buck-boost DC/DC ICs support wider input range.

	RP118	RP511/2 RP516/7	RP604	RP124	RP514/5	RP605
Type	LDO	Buck	Buck/Boost	LDO+BM	Buck+BM	B/B+BM
Iq	0.2uA	0.3uA	0.3uA	0.2uA +0.1uA	0.3uA +0.1uA	0.3uA +0.1uA

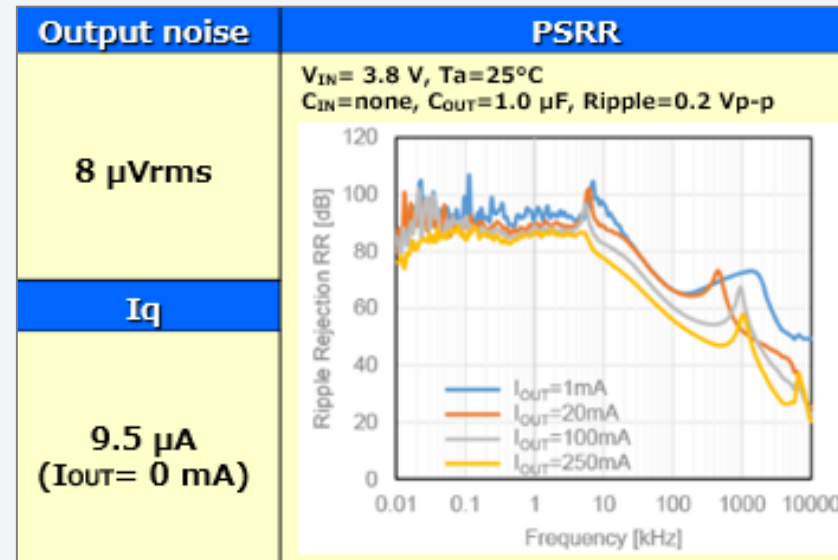


### Low noise LDO

Sensor's accuracy should be higher and higher.



High PSRR/Low noise output & Low consumption current of IC itself are realized at the same time, low noise LDO series solve this issue.



RP122/123  
Typical Characteristics



Supporting your IoT system construction

- ✓ *Ultra-low supply current*
- ✓ *Low noise*
- ✓ *Low electromotive force*
- ✓ *Battery monitoring*

### ULTRA-LOW SUPPLY CURRENT

**Ultra-low supply current**  
Power management IC contributes to battery life

### LOW NOISE

**Low noise**  
Power management IC reduces noise influence

### LOW ELECTROMOTIVE FORCE

**Low electromotive force**  
Power management IC supports energy harvesting technology

### BATTERY MONITORING

**Battery monitoring**  
Power management IC capable of battery voltage monitoring

<https://www.nisshinbo-microdevices.co.jp/en/applications/iot/>



**Nisshinbo Micro Devices Inc.**