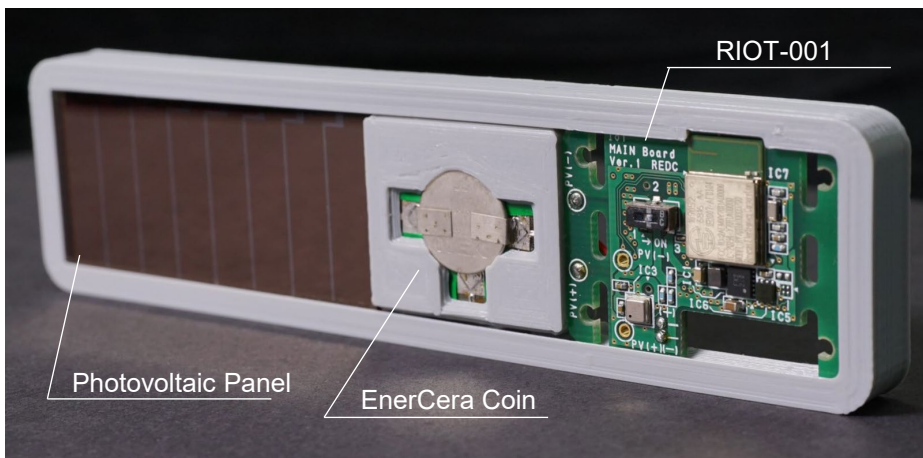
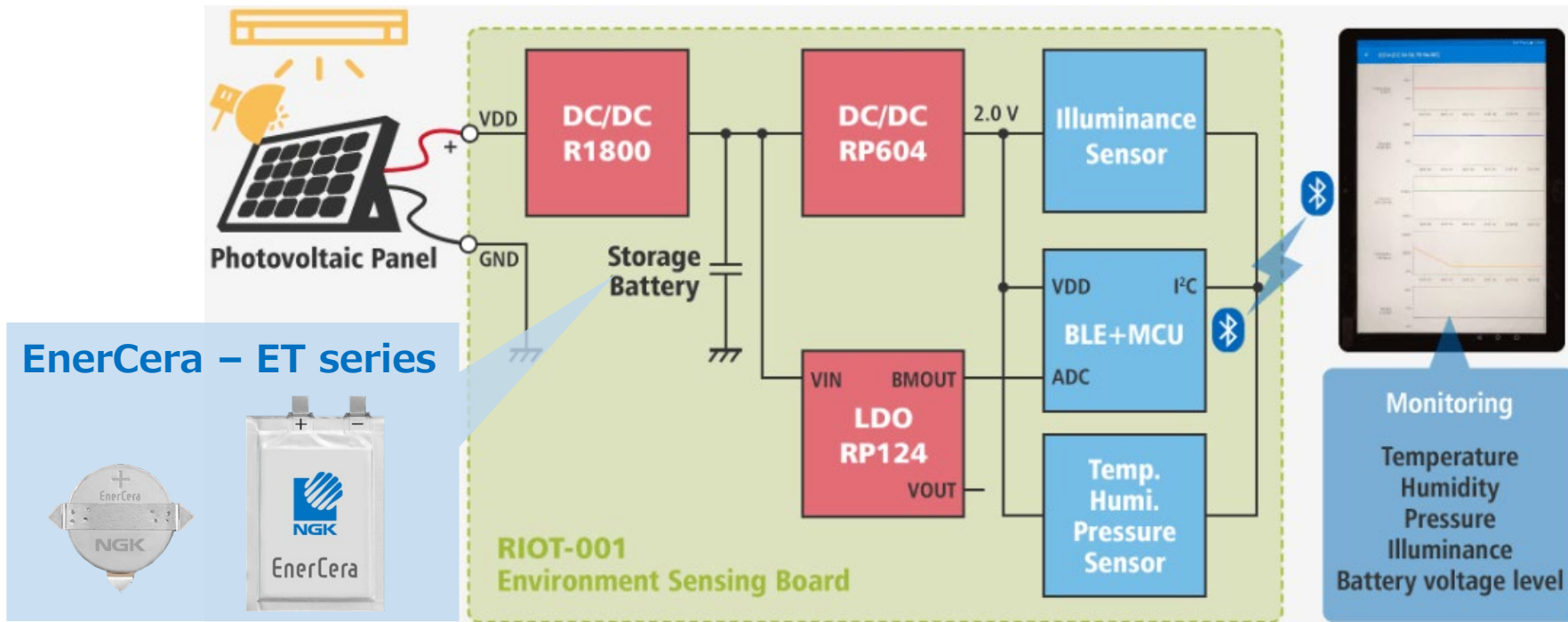


**Maintenance-free Environment Sensor
with
EnerCera**

Maintenance-free Environment Sensing Demo-Board

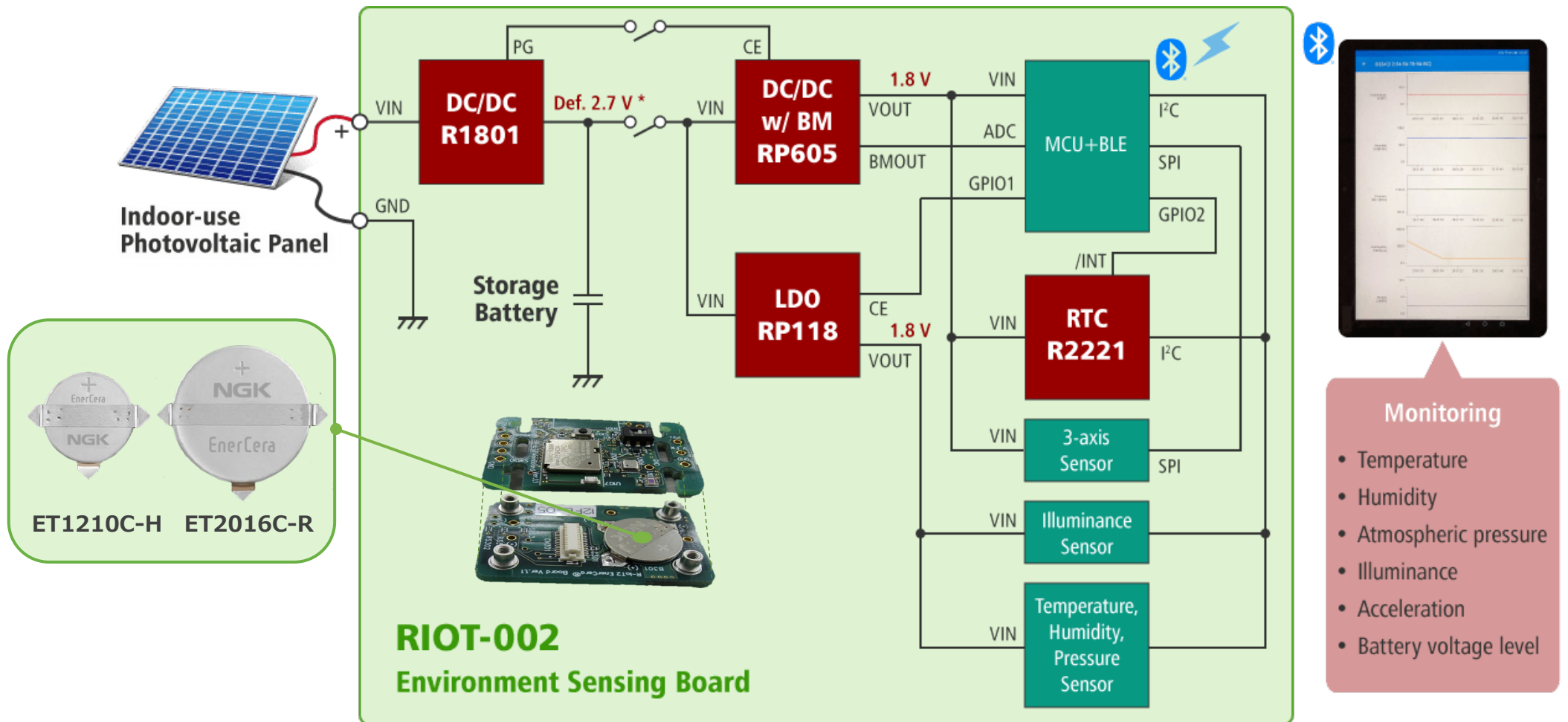
RIOT-001+EnerCera®



- ✓ 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®



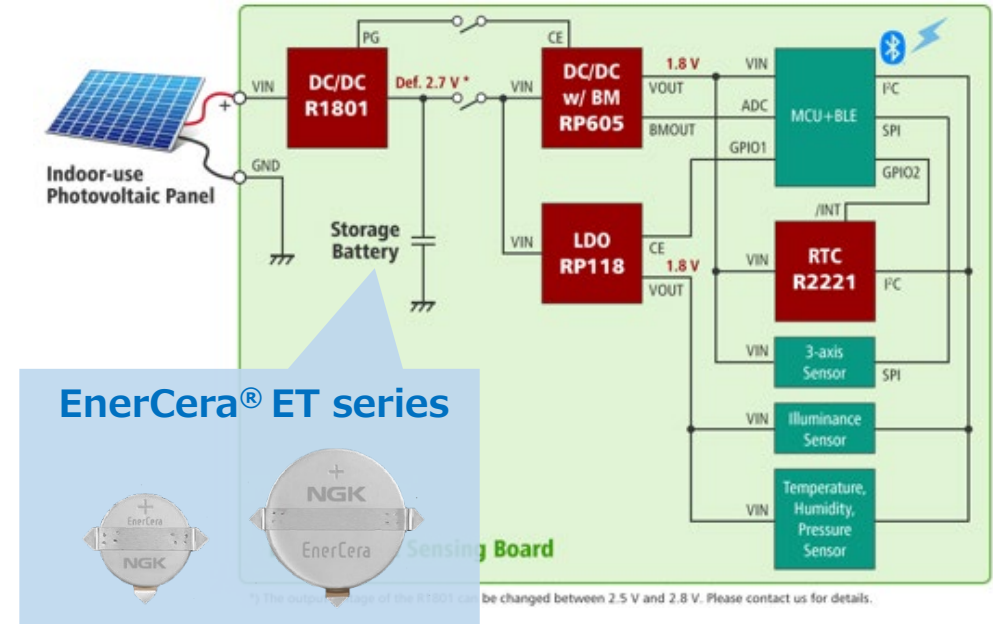
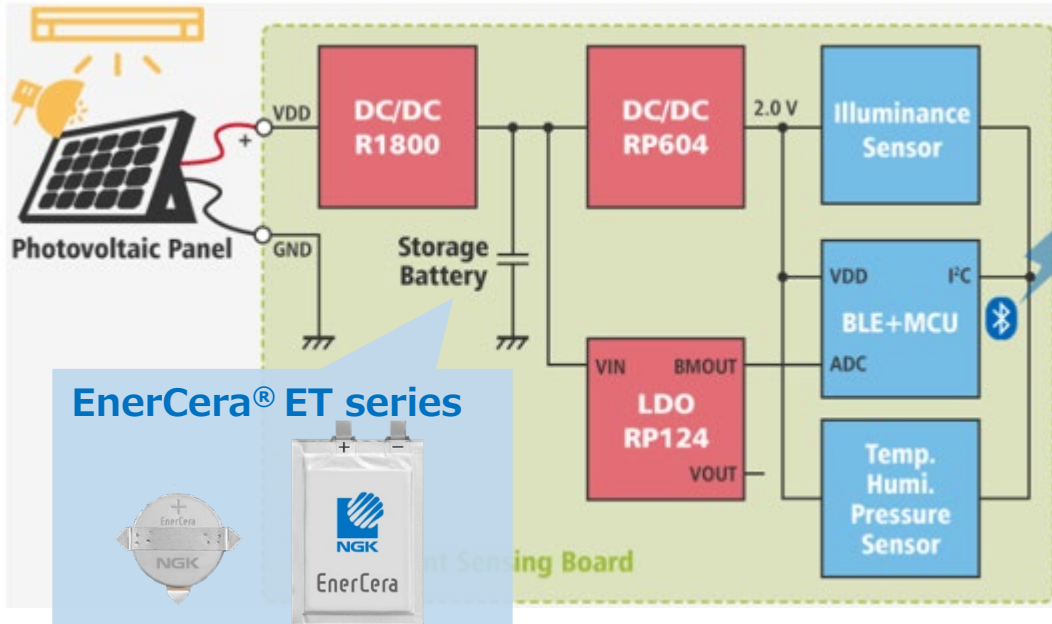
*) The output voltage of the R1801 can be changed between 2.5 V and 2.8 V. Please contact us for details.

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

<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
R1800	Buck	☉ Multi-cell
R1801	Buck	☉ Multi-cell
R1810	Boost	☉ 1cell

Ultra Low Iq Discrete ICs

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

Low noise LDO

PN
RP122 RP123

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
R1800	Buck	☉ Multi-cell	○	2.0~5.5V	2.0~5.3V 0.1V step	2.0~4.5V 0.1V step	144nA
R1801	Buck	☉ Multi-cell	○	2.2~5.5V	2.2~5.3V Limited adjustment by logic pins	2.2~4.5V	200nA
R1810	Boost	☉ 1cell	○	0.35~2.1V	0.2~2.1V 50mV step	2.0~4.5V 0.1V step	600nA

Ultra Low Iq Discrete ICs
+ Battery Monitor supporting

PN	Type	Iq	Iout	Vin	Vout
RP118	LDO	0.2uA	100mA	1.7V-5.5V	1.2V-3.6V
RP511 RP512	Buck	0.3uA	100mA 300mA	2.0V-5.5V	1.0V-4.0V
RP516 RP517	Buck	0.3uA	100mA 300mA	1.8V-5.5V	0.3V-1.2V
RP604	Buck/Boost	0.3uA	300mA(Buck)	1.8V-5.5V	1.6V-5.2V
RP124	LDO + BM	0.2uA + 0.1uA	100mA	1.7V-5.5V	LDO : 1.2V-3.6V BM : 1/3, 1/4
RP514 RP515	Buck + BM	0.3uA + 0.1uA	100mA 300mA	1.8V-5.5V	Buck : 1.0V-4.0V BM : 1/3, 1/4
RP605	Buck/Boost + BM	0.3uA + 0.1uA	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
RP122 RP123	10uA	400mA 250mA	8uVrms	90dB, 65dB	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 _q	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

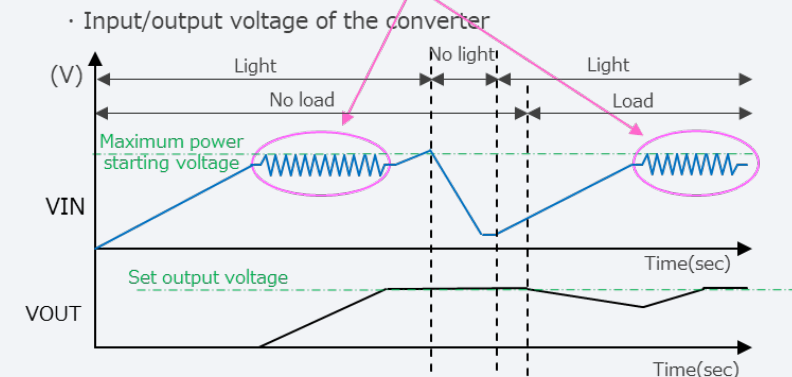
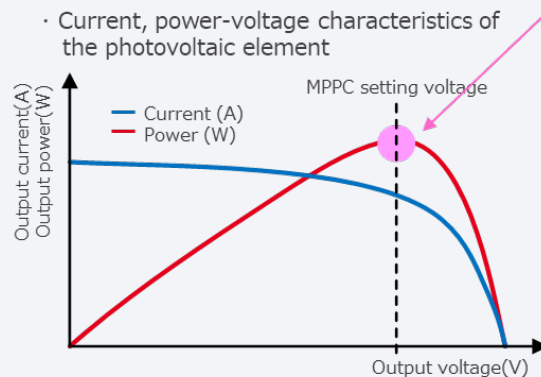
Energy Harvesting Discrete ICs

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

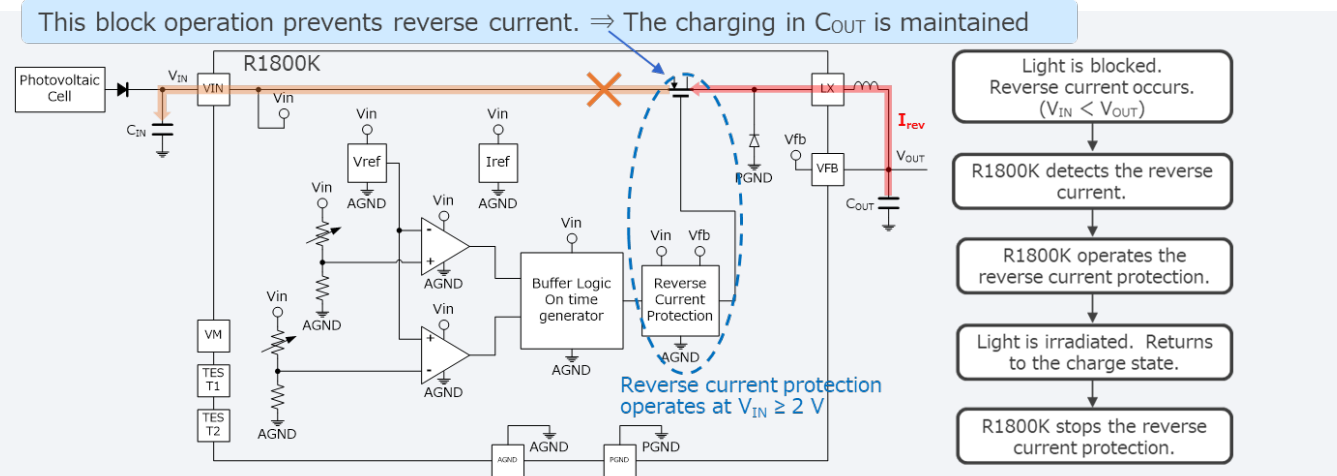


Technical Tips for Micro Power Generation/Energy Harvest/Maintenance-free IoT devices

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.

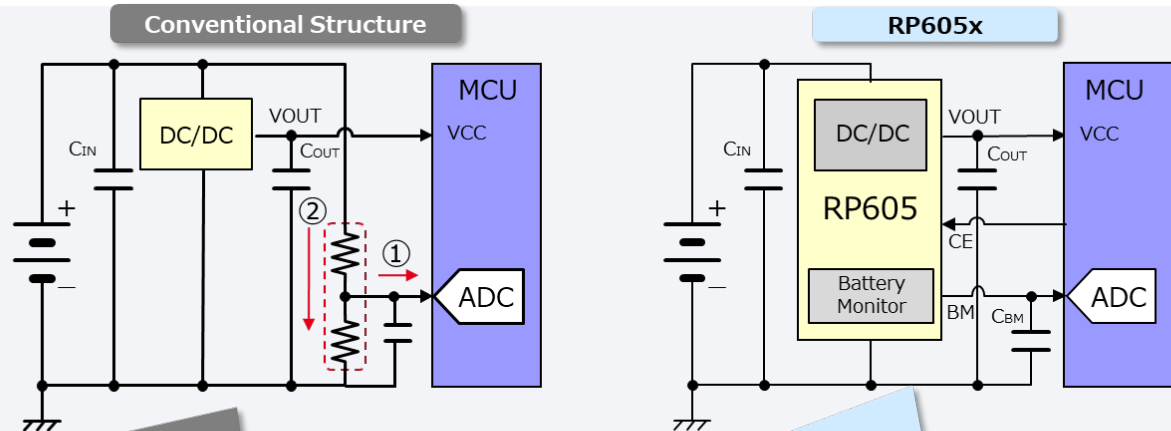


Reverse Current Protection helps stable operation and high efficiency operation of the System

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

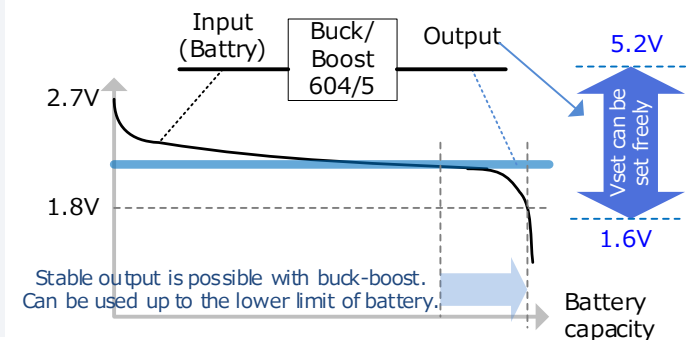
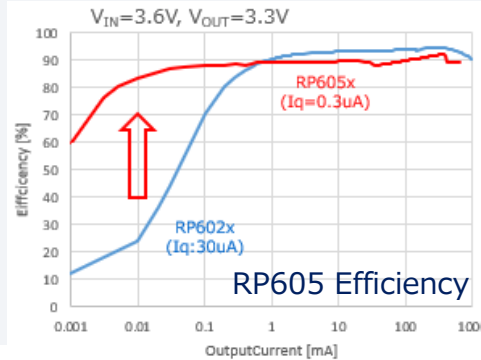
Ultra Low Iq Discrete ICs

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

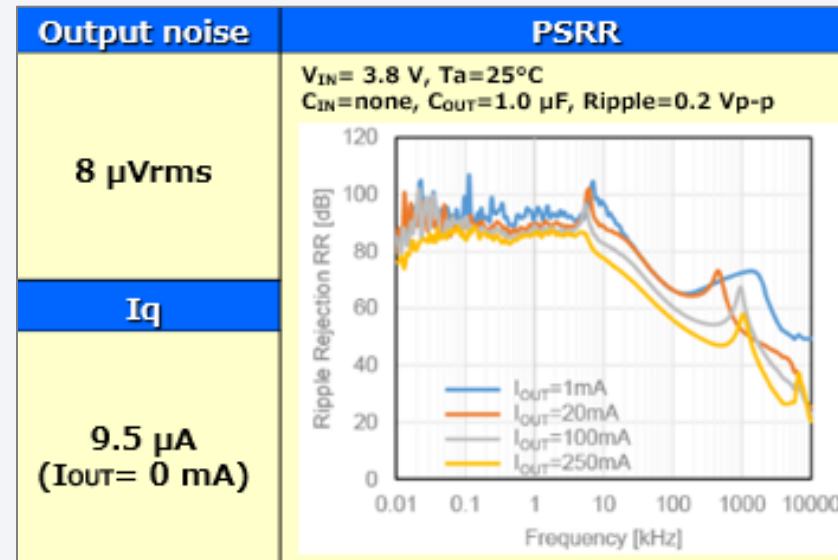


Low noise LDO

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

PMICs that support for Maintenance-free IoT devices

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.