



CYPRESS[®]
EMBEDDED IN TOMORROW™

Cypress Roadmap: Energy Harvesting PMIC

Q2 2018



Energy Harvesting PMIC¹ Portfolio

Series Solar Cell by
Panasonic (AM-1801)



Single Solar Cell by
Ningbo Hebe Solar (HSC125155)



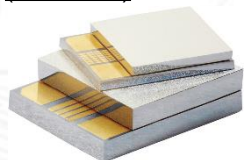
Piezoelectric Device by
Thrive (K7520BS3)



Electromagnetic Device by
Perpetuum (PMG-FSH)



TEG by Micropelt
(TGP-651)



Light
Series
Solar Cell

Light
Single
Solar Cell

Vibration
Piezoelectric,
Electromagnetic

Heat
Thermoelectric
Generator (TEG)

Wearable Activity Monitor	Residential WSNs ² for HVAC ³ , Level of Light Emitted, Temperature, Humidity, Motion	Building WSNs for HVAC, Level of Light Emitted, Temperature, Humidity, Motion, BLE ⁴ Beacon ⁵	Industrial WSNs for Infrastructure, Agriculture, Transportation, Factory Automation, Animal Monitoring	
Indoor/Outdoor			Indoor	Outdoor
NEW S6AE101A Linear, Power Gating ⁶ , Multiplexer ⁷ , 10-pin QFN	NEW S6AE101A Linear, Power Gating, Multiplexer, 10-pin QFN	NEW S6AE102A Linear, Power Gating, Multiplexer, LDO ⁸ , Comparator, 20-pin QFN	NEW S6AE103A Linear, PowerGating, Multiplexer, LDO, Timer, Comparator, 24-pin QFN	
	MB39C811 Buck DC/DC, Dual-Bridge Rectifier, Power Good, 40-pin QFN	MB39C811 ⁹ Buck DC/DC, Dual-Bridge Rectifier, Power Good, 40-pin QFN	MB39C811 ⁹ Buck DC/DC, Dual-Bridge Rectifier, Power Good, 40-pin QFN	MB39C831 Boost DC/DC, MPPT ¹⁰ , Li-ion Protection, 40-pin QFN
	MB39C811 ⁹ Buck DC/DC, Dual-Bridge Rectifier, Power Good, 40-pin QFN	MB39C811 ⁹ Buck DC/DC, Dual-Bridge Rectifier, Power Good, 40-pin QFN		
		MB39C831 Boost DC/DC, MPPT, Li-ion Protection, 40-pin QFN		

Market Segment →

¹ Power Management IC

² Wireless sensor nodes

³ Heating, ventilation, air conditioning

⁴ Bluetooth Low Energy

⁵ A wireless device that transmits data (e.g., signal strength and ID) over a periodic radio signal from a known location

⁶ Output power control circuit that controls power provided to the system load

⁷ Power source switch circuit for primary battery or energy harvesting device

⁸ Low dropout regulator

⁹ Not recommended for new designs

¹⁰ Maximum power point tracking

Status Availability

Concept	Development	Sampling	Production



S6AE101A

Solar-Optimized Energy Harvesting Power Management IC (PMIC)

Applications

Series solar cell energy harvesting¹ and wireless sensor nodes²

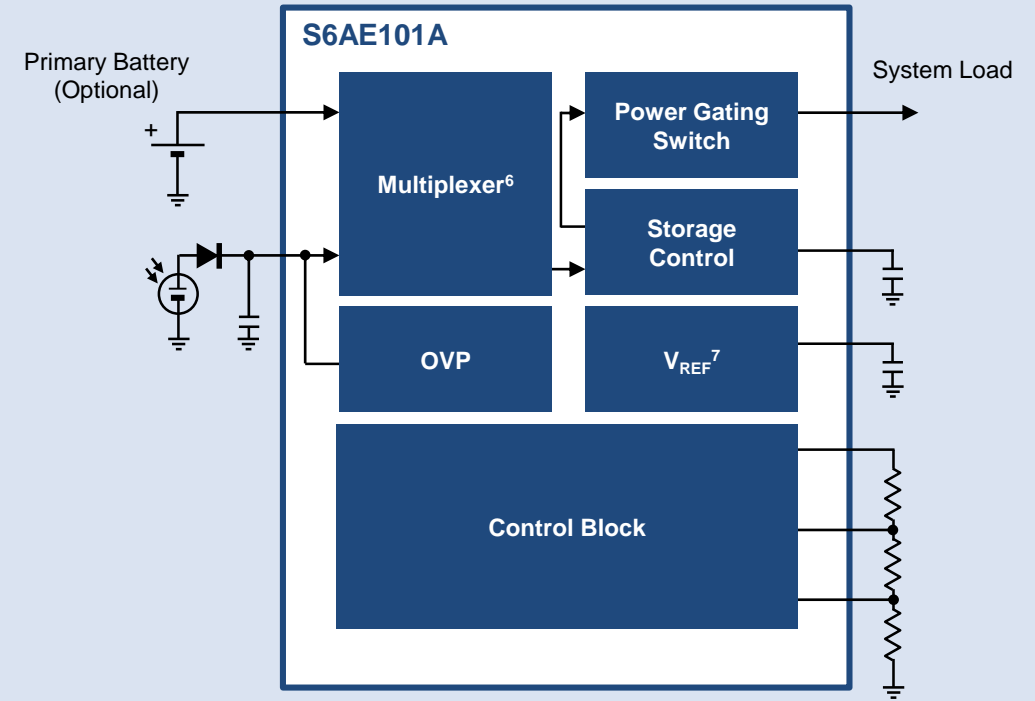
Features

- **Ultra-Low Power**
 - Enables 1 cm² minimum solar cell size for startup operation³
- **Input Voltage Range**
 - 2.0–5.5 V (series solar cell and primary battery)
- **1.1–5.2-V Output Voltage Range**
- **250-nA Quiescent Current⁴**
- **1.2- μ W Startup Power**
- **Power Gating⁵ Switch Circuit**
- **Storage Control Circuit**
- **Multiplexer⁶ Circuit (battery vs. solar cell)**
- **Overvoltage Protection (OVP)**
- **Packages**
 - 3.0 mm x 3.0 mm 10-pin SON

Collateral

- Datasheet:** [S6AE101A Datasheet](#)
- Development Kits:** [Solar-Powered IoT Device Kit](#)
[S6AE10xA Evaluation Board](#)
- Software:** [Easy DesignSim™ Software](#)

S6AE101A: Solar-Optimized Energy Harvesting PMIC



Availability

Production: Now

¹ The process of capturing and converting tiny amounts of energy (e.g., from light, vibration or heat) into electricity

² A sensor-based device that monitors conditions such as temperature, humidity and pressure and wirelessly transmits that data to a control unit, such as a PC or a mobile device

³ Estimate based on solar cell power = 2 μ W/cm² at 100 lx

⁴ Current consumed at no load condition

⁵ Output power control circuit that controls power provided to the system load

⁶ Power source switch circuit for primary battery and Energy Harvesting Device

⁷ Voltage reference circuit for internal block

S6AE102A

Solar-Optimized Energy Harvesting Power Management IC (PMIC)

Applications

Series solar cell energy harvesting¹ and wireless sensor nodes²

Features

- **Ultra-Low Power**
 - Enables 1 cm² minimum solar cell size for startup operation³
- **Input Voltage Range**
 - Series solar cell: 2.0–5.5 V (series solar cell and primary battery)
- **1.1–5.2-V Output Voltage Range**
- **280-nA Quiescent Current⁴**
- **1.2-μW Startup Power**
- **400-nA Low Quiescent Current Low Dropout Regulator (LDO)**
- **Dual-Channel Power Gating⁵ Switch Circuit with Interrupt Request (IRQ) Control Function for Power Management**
- **Signal Output Circuit of Power Gating Switch Control**
- **Multiplexer⁶ Circuit (battery vs. solar cell)**
- **Hybrid Storage Control Circuit⁷ and Overvoltage Protection (OVP)**
- **Packages**
 - 4.0 mm x 4.0 mm 20-pin QFN

Collateral

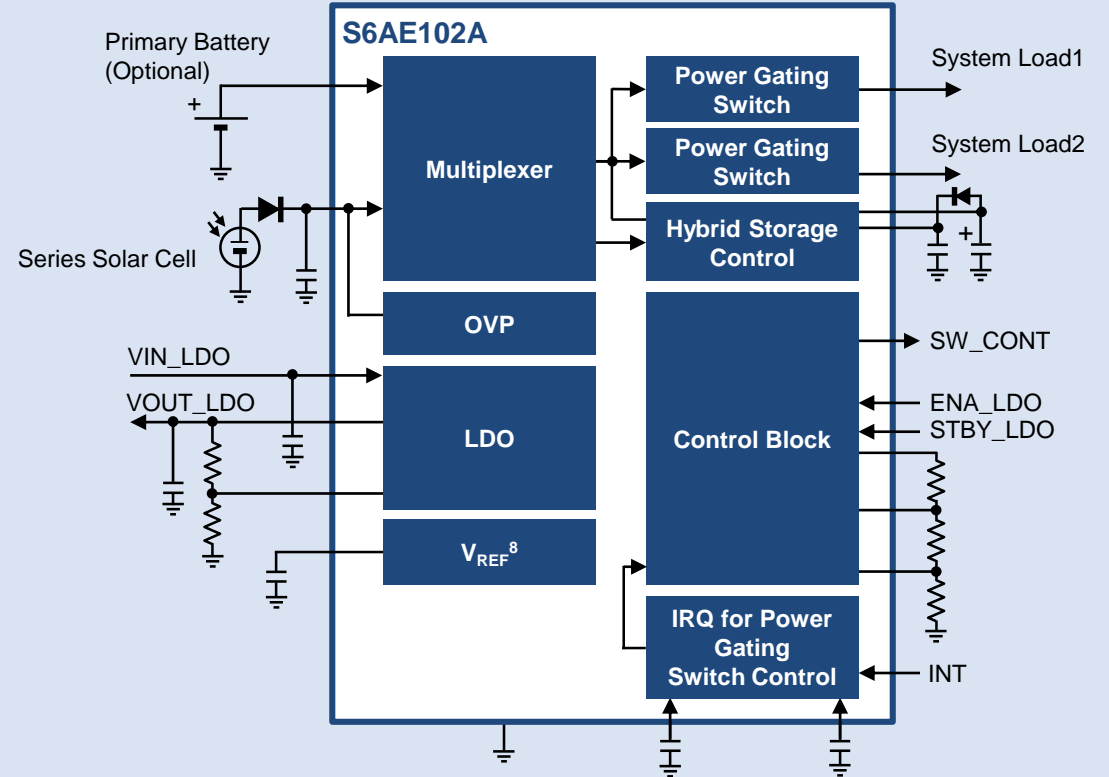
Datasheet: [S6AE102A Datasheet](#)

Development Kits: [S6AE10xA Evaluation Board](#), [CYALKIT-E04](#)

Software: [Easy DesignSim™ Software](#)

¹ The process of capturing and converting tiny amounts of energy (e.g., from light, vibration or heat) into electricity
² A sensor-based device that monitors conditions such as temperature, humidity and pressure and wirelessly transmits that data to a control unit, such as a PC or a mobile device
³ Estimate based on solar cell power = 2 μW/cm² at 100 lx
⁴ Current consumed at no load condition

S6AE102A: Solar-Optimized Energy Harvesting PMIC



Availability

Production: Now

⁵ Output power control circuit that controls power provided to the system load

⁶ Power source switch circuit for primary battery or series solar cell

⁷ Uses a small and large capacitor to automatically store excess power for backup

⁸ Voltage reference circuit for internal block

S6AE103A

Solar-Optimized Energy Harvesting Power Management IC (PMIC)

Applications

Series solar cell energy harvesting¹ and wireless sensor nodes²

Features

- **Ultra-Low Power**
 - Enables 1 cm² minimum solar cell size for startup operation³
- **Input Voltage Range**
 - 2.0-5.5 V (series solar cell and primary battery)
- **1.1–5.2 V Output Voltage Range**
- **280 nA Quiescent Current⁴**
- **1.2 μW Startup Power**
- **400 nA Low Quiescent Current Low Dropout Regulator (LDO)**
- **30 nA Low Consumption Current CR Timer⁵**
- **20 nA General-Purpose Low Consumption Current Comparator**
- **Dual-Channel Power Gating⁶ Switch Circuit with Interrupt Request (IRQ) Control Function for Power Management**
- **Signal Output Circuit of Power Gating Switch Control**
- **Multiplexer⁷ Circuit (battery vs. solar cell)**
- **Hybrid Storage Control Circuit⁸ and Overvoltage Protection (OVP)**
- **Packages**
 - 4.0 mm x 4.0 mm 20-pin QFN

Collateral

Datasheet: [S6AE103A Datasheet](#)

Development Kits: [S6AE10xA Evaluation Board](#), [CYALKIT-E04](#)

Software: [Easy DesignSim™ Software](#)

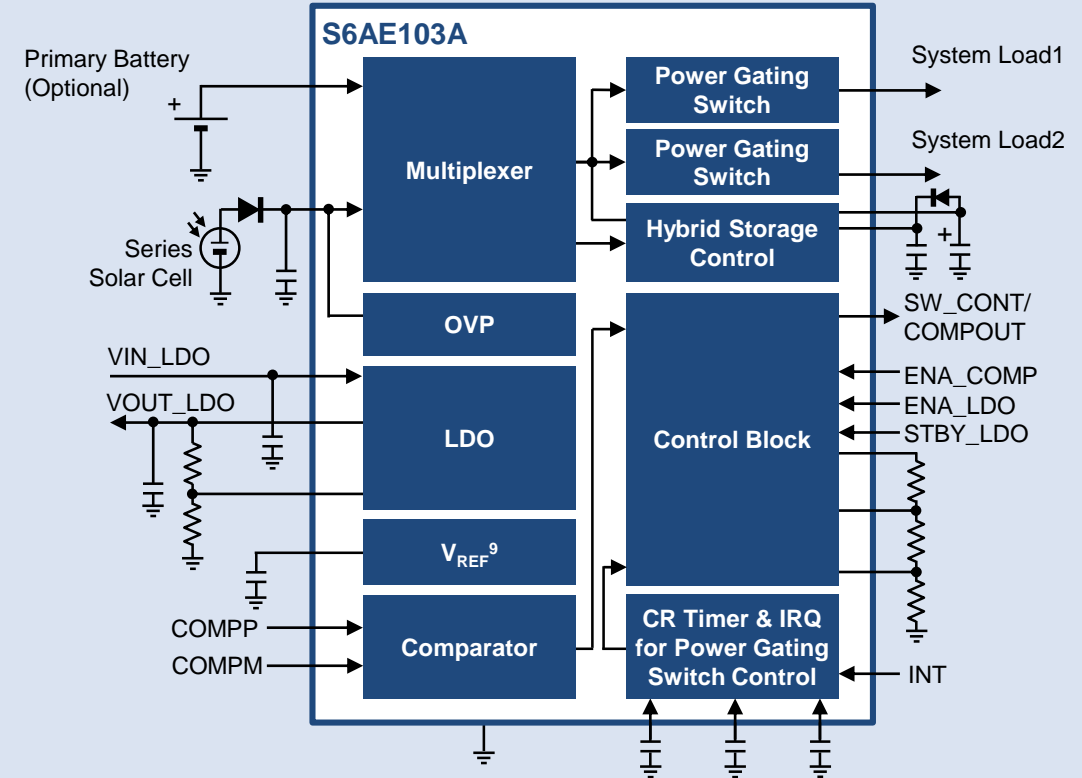
¹ The process of capturing and converting tiny amounts of energy (e.g., from light, vibration or heat) into electricity

² A sensor-based device that monitors conditions such as temperature, humidity and pressure and wirelessly transmits that data to a control unit, such as a PC or a mobile device

³ Estimate based on solar cell power = 2 μW/cm² at 100 lx

⁴ Current consumed at no load condition

S6AE103A: Solar-Optimized Energy Harvesting PMIC



Availability

Production: Now

⁶ Output power control circuit that controls power provided to the system load

⁷ Power source switch circuit for primary battery or series solar cell

⁸ Uses a small and large capacitor to automatically store excess power for backup

⁹ Voltage reference circuit for internal block

MB39C811¹

General Purpose Energy Harvesting Power Management IC (PMIC)

Applications

Series solar cell energy harvesting², Piezoelectric³ energy harvesting and wireless sensor nodes (WSN)⁴

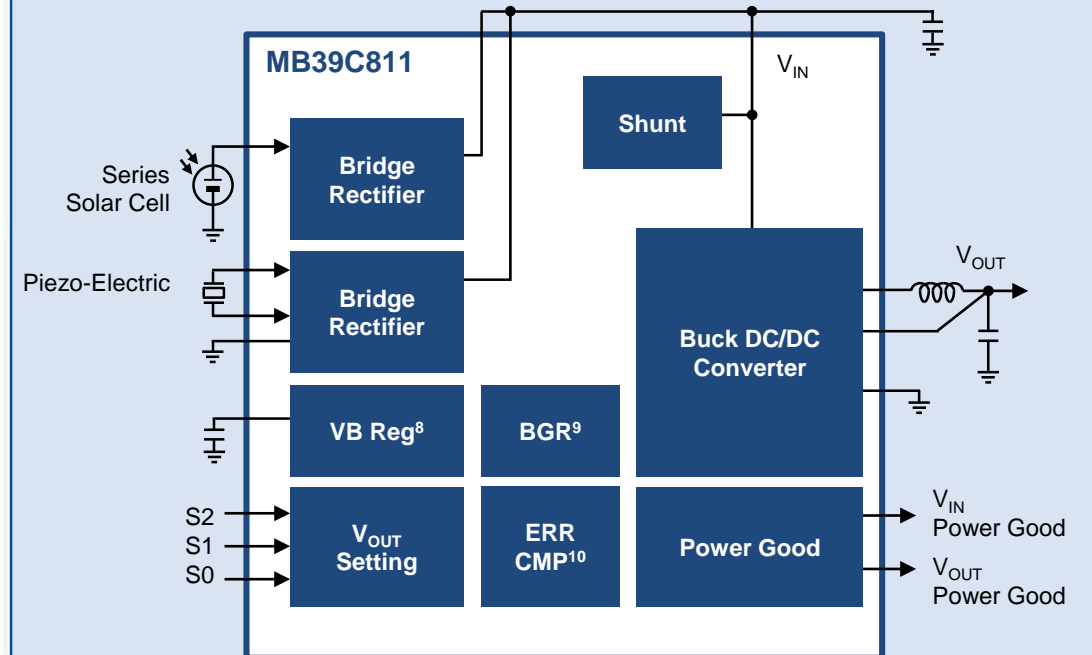
Features

- **Ultra-Low-Power Buck DC/DC Converter Dual-Bridge Rectifiers**
- **1.5 μA Quiescent Current⁵**
- **2.6–23-V Input Voltage Range**
- **Output Voltage**
 - 1.5 V, 1.8 V, 2.5 V, 3.3 V, 3.6 V, 4.1 V, 4.5 V, and 5.0 V
- **100 mA (maximum) Output Current**
- **Overcurrent Protection (OCP)**
- **Low-Loss Full-Wave Bridge Rectifier**
 - V_F ⁶ = 0.28 V (I_F = 10 μA), I_{R7} = 20 nA_{MAX} ($V_{REVERSE}$ = 18 V)
- **Shunt for Input Protection**
 - $V_{IN} \geq 21$ V (up to 100-mA pulldown)
- **Input and Output Power Good Monitoring**
- **Package**
 - 6.0 mm x 6.0 mm 40-pin QFN

Collateral

Datasheet: [MB39C811 Datasheet](#)
Development Kits: [Energy Harvesting Starter Kit](#)
[MB39C811 Evaluation Board](#)
Software: [Easy DesignSim™ Software](#)

MB39C811: General Purpose Energy Harvesting PMIC



Availability

Production: Now

¹ Not recommended for new designs

² The process of capturing and converting tiny amounts of energy (e.g., from light, vibration or heat) into electricity

³ Power generation device using vibration

⁴ A sensor-based device that monitors conditions such as temperature, humidity and pressure and wirelessly transmits that data to a control unit, such as a PC or a mobile device

⁵ Current consumed at no load condition

⁶ Bridge rectifier reverse breakdown voltage

⁷ Bridge rectifier reverse bias leak current

⁸ Regulator for internal block

⁹ Band Gap Reference

¹⁰ Error Comparator

MB39C831

General Purpose Energy Harvesting Power Management IC (PMIC)

Applications

Single solar cell energy harvesting¹, thermoelectric generator² energy harvesting and wireless sensor nodes³

Features

- **Ultra-Low-Voltage Startup Boost DC/DC Converter**
- **0.3–4.75-V Input Voltage Range**
- **0.35-V Startup Voltage**
- **Output Voltage (constant voltage mode only)**
 - 3.0 V, 3.3 V, 3.6 V, 4.1 V, 4.5 V and 5.0 V
- **32- μ A Quiescent Current⁴**
- **Output Current**
 - 8 mA ($V_{DD} = 0.6$ V, $V_{OUT} = 3.3$ V) and 80 mA ($V_{DD} = 3.0$ V, $V_{OUT} = 3.3$ V)
- **200-mA Input Peak Current Limit**
- **Built-In Maximum Power Point Tracking (MPPT)⁵ Function**
- **Built-In Li-ion Charge Function**
- **Input and Output Power Good Monitoring**
- **Package**
 - 6.0 mm x 6.0 mm 40-pin QFN

Collateral

Datasheet: [MB39C831 Datasheet](#)
Development Kits: [MB39C831 Evaluation Board](#)
Software: [Easy DesignSim™ Software](#)

¹ The process of capturing and converting tiny amounts of energy (e.g., from light, vibration or heat) into electricity

² Power Generation Device using heat

³ A sensor-based device that monitors conditions such as temperature, humidity and pressure and wirelessly transmits that data to a control unit, such as a PC or a mobile device

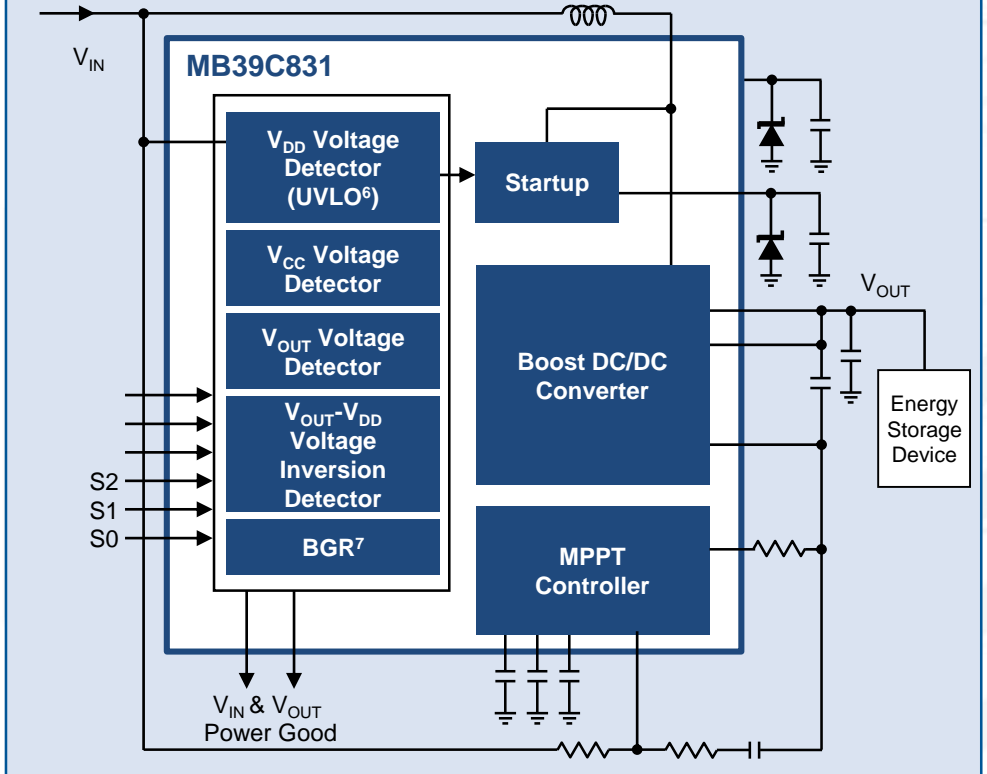
⁴ Current consumed at no load condition

⁵ Maximum Power Point Tracking maximizes the Energy Harvest by adjusting current drawn from a solar panel

⁶ Undervoltage lockout

⁷ Band Gap Reference

MB39C811: General Purpose Energy Harvesting PMIC



Availability

Production: Now



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