

Product Catalog

Switching Regulators (DC-DC Converters), 2025
Boost Charge Pumps, Power Sequencers

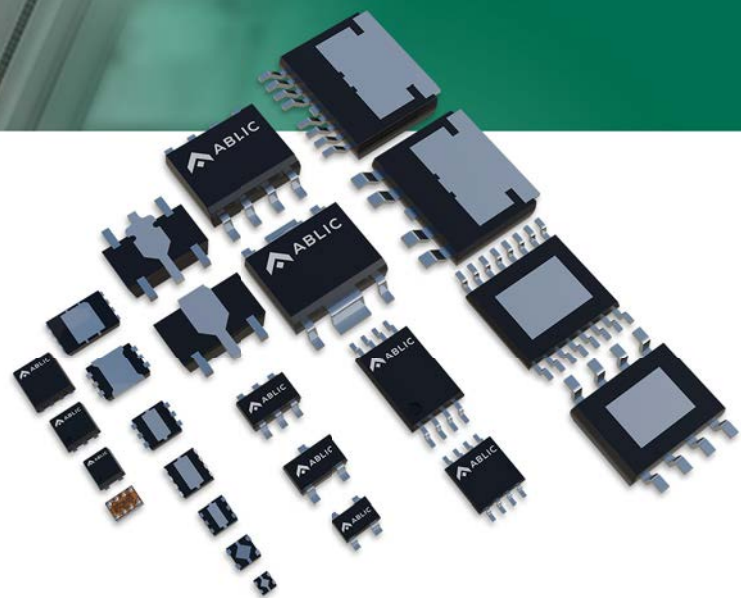


Table of Contents

| Features | Series Name | Page |
|--|--------------------------------------|------|
| Product Lineup | | |
| Switching Regulators (DC-DC Converters) | | II |
| Boost Charge Pump ICs | | III |
| Power Sequencer | | III |
| Switching Regulators (DC-DC Converters) | | |
| Step-up, for LCD Bias Supply, 1-channel, PWM Control Switching Regulator Controller | S-8333 Series | 1 |
| Step-up High-frequency, PWM Control Switching Regulator (DC-DC Converter ICs) Controllers | S-8337/8338 Series | 2 |
| Super-Small Package PFM Control Step-Up Switching Regulator (DC-DC Converter ICs) | S-8351/8352 Series | 3 |
| Super-Small Package PWM Control, PWM/PFM Control Step-Up Switching Regulator (DC-DC Converter ICs) | S-8353/8354 Series | 4 |
| Super-Small Package PWM Control, PWM/PFM Control Step-Up Switching Regulator (DC-DC Converter ICs) | S-8355/56/57/58 Series | 5 |
| PWM Control & PWM/PFM Control Step-Down Switching Regulator (DC-DC Converter ICs) | S-8520/8521 Series | 6 |
| Synchronous PWM Control Step-Down Switching Regulator (DC-DC Converter ICs) | S-8533 Series | 7 |
| 36V Input, 600 mA Synchronous Step-Down Switching Regulator | S-8580AA/8580AB/8581AA/8581AB Series | 8 |
| 36V Input, 600 mA Synchronous Step-Down Switching Regulator | S-8580AC/8580AD/8581AC/8581AD Series | 9 |
| 18V Input, 600 mA Synchronous Step-Down Switching Regulator | S-8590AA/8590AB/8591AA/8591AB Series | 10 |
| 18V Input, 600 mA Synchronous Step-Down Switching Regulator | S-8590AC/8590AD/8591AC/8591AD Series | 11 |
| 5.6 V Input, 50 mA, Low EMI, Synchronous Step-down Switching Regulator with 260 nA Quiescent Current | S-85M0A Series (WLP product) | 12 |
| 5.6 V Input, 200 mA, Low EMI, Synchronous Step-down Switching Regulator with 260 nA Quiescent Current | S-85M1A Series (WLP product) | 13 |
| 5.5 V Input, 50 mA Synchronous Step-Down Switching Regulator with 260 nA Quiescent Current | S-85S0A Series | 14 |
| Supply Voltage Divided Output, 5.5 V Input, 50 mA Synchronous Step-down switching Regulator with 260 nA Quiescent Current | S-85S0P Series | 15 |
| 5.5v Input, 200mA Synchronous Step-Down Switching Regulator with 260nA Quiescent Current | S-85S1A Series | 16 |
| Supply Voltage Divided Output, 5.5 V Input, 200 mA Synchronous Step-down Switching Regulator with 260 nA Quiescent Current | S-85S1P Series | 17 |
| 5.5 V Input, 200 mA Synchronous Step-down Switching Regulator with 10 μ A Quiescent Current | S-85V1A Series | 18 |
| Boost Charge Pump ICs | | |
| Voltage Regulation Boost Charge Pump DC-DC Converter | S-8821 Series | 19 |
| Power Sequencer | | |
| Power Sequencer | S-77100/77101 Series | 20 |
| Packages | | |
| Package List | | 21 |

Switching Regulators (DC-DC Converters)

[Switching Regulators \(DC-DC Converters\) on ablic.com](#)

| Series Name | Features | Type | Control | Transistor | VIN min. [V] | VIN max. [V] | VOUT min. [V] | VOUT max. [V] | IOUT [A] | Frequency [Hz] | ISS typ. [μA] | Istandby max. [μA] | Efficiency [%] | COUT | Protection Circuit | Operation temp. min. [°C] | Operation temp. max. [°C] | Package | Page |
|---------------------------------------|---|-----------|--|--------------------|--------------|--------------|---------------|---------------|------------|------------------------|---------------|--------------------|----------------|---------|---|---------------------------|---------------------------|--------------------------------------|------|
| S-8333 | Responsive | Step-up | PWM control | External | 1.8 | 6.0 | Variable | Variable | 2.00 | 280k to 1080k | 450 | - | 93 | Ceramic | Short-circuit protection | -40 | 85 | SNT-8A, 8-pin TSSOP | 1 |
| S-8337/8338 | Responsive | Step-up | PWM control | External | 1.8 | 6.0 | Variable | Variable | 2.00 | 286k to 1133k | 400 | 1.0 | 93 | Ceramic | Short-circuit protection | -40 | 85 | 8-pin TSSOP | 2 |
| S-8351/8352 | Low voltage | Step-up | PFM control | Built-in, External | 0.9 | 10.0 | 2.00 | 6.5 | 0.15, 0.40 | 100k | 23.2 | 0.5 | 87 | - | - | -40 | 85 | SOT-23-5, SOT-23-3, SOT-89-3 | 3 |
| S-8353/8354 | Low voltage, Efficient | Step-up | PWM control, PWM/PFM switching control | Built-in | 0.9 | 10.0 | 2.00 | 6.5 | 0.30 | 30 k, 50 k, 250k | 18.7 | 0.5 | 92 | - | - | -40 | 85 | SOT-23-5, SOT-23-3, SOT-89-3 | 4 |
| S-8355/56/57/58 | Low voltage, Efficient | Step-up | PWM control, PWM/PFM switching control | External | 0.9 | 10.0 | 2.00 | 6.5 | 1.00 | 100k, 250k, 300k, 600k | 25.9 | 0.5 | 93 | - | - | -40 | 85 | SOT-23-5, SOT-23-3, SOT-89-3 | 5 |
| S-8520/8521 | Efficient | Step-down | PWM control, PWM/PFM switching control | External | 2.5 | 16.0 | 1.50 | 6.0 | 1.00 | 60 k, 180k, 300k | 60.0 | 0.5 | 93 | - | - | -40 | 85 | SOT-23-5 | 6 |
| S-8533 | Synchronous | Step-down | Synchronous PWM control | External | 2.7 | 16.0 | 1.25 | 6.0 | 3.00 | 300k | 30.0 | 1.0 | 95 | - | - | -40 | 85 | 8-pin TSSOP | 7 |
| S-8580AA/8580AB /8581AA/8581AB | 36V Input, Synchronous, Small package | Step-down | PWM control, PWM/PFM switching control | Built-in | 4.0 | 36.0 | 2.50 | 12.0, 30.0 | 0.60 | 2200k | 68.0, 175 | 1.0 | 91 | Ceramic | Current limit, Short-circuit protection, Thermal shutdown | -40 | 85 | HTMSOP-8, HSNT-8(2030), HSNT-6(2025) | 8 |
| S-8580AC/8580AD /8581AC/8581AD | 36V Input, Synchronous, Small package | Step-down | PWM control, PWM/PFM switching control | Built-in | 4.0 | 36.0 | 2.50 | 12.0 | 0.60 | 400k | 68.0, 150 | 1.0 | 95 | Ceramic | Current limit, Short-circuit protection, Thermal shutdown | -40 | 85 | HTMSOP-8, HSNT-8(2030), HSNT-6(2025) | 9 |
| S-8590AA/8590AB /8591AA/8591AB | 18V Input, Synchronous, Small package | Step-down | PWM control, PWM/PFM switching control | Built-in | 4.0 | 18.0 | 1.00 | 12.0 | 0.60 | 2200k | 68.0, 175 | 1.0 | 91 | Ceramic | Current limit, Short-circuit protection, Thermal shutdown | -40 | 85 | HTMSOP-8, HSNT-8(2030), HSNT-6(2025) | 10 |
| S-8590AC/8590AD /8591AC/8591AD | 18V Input, Synchronous, Small package | Step-down | PWM control, PWM/PFM switching control | Built-in | 4.0 | 18.0 | 2.50 | 12.0 | 0.60 | 400k | 68.0, 150 | 1.0 | 95 | Ceramic | Current limit, Short-circuit protection, Thermal shutdown | -40 | 85 | HTMSOP-8, HSNT-8(2030), HSNT-6(2025) | 11 |
| S-85M0A | Ultra-efficient, Synchronous, Super-small | Step-down | PFM control | Built-in | 2.2 | 5.6 | 0.70 | 3.9 | 0.05 | - | 0.26 | 0.1 | 91 | Ceramic | Current limit, Short-circuit protection, Thermal shutdown | -40 | 85 | WLP-6L | 12 |
| S-85M1A | Ultra-efficient, Synchronous, Super-small | Step-down | PWM/PFM switching control | Built-in | 2.2 | 5.6 | 0.70 | 3.9 | 0.20 | 1000k | 0.26 | 0.1 | 93 | Ceramic | Current limit, Short-circuit protection, Thermal shutdown | -40 | 85 | WLP-6L | 13 |
| S-85S0A | Ultra-efficient, Synchronous | Step-down | PFM control | Built-in | 2.2 | 5.5 | 0.70 | 3.9 | 0.05 | - | 0.26 | 0.1 | 91 | Ceramic | Current limit, Short-circuit protection, Thermal shutdown | -40 | 85 | SNT-6A | 14 |
| S-85S0P | Ultra-efficient, Synchronous, Supply voltage divided output | Step-down | PFM control | Built-in | 2.2 | 5.5 | 0.70 | 3.9 | 0.05 | - | 0.54 | 0.1 | 91 | Ceramic | Current limit, Short-circuit protection, Thermal shutdown | -40 | 85 | SNT-8A | 15 |
| S-85S1A | Ultra-efficient, Synchronous | Step-down | PWM/PFM switching control | Built-in | 2.2 | 5.5 | 0.70 | 3.9 | 0.20 | 1000k | 0.26 | 0.1 | 93 | Ceramic | Current limit, Short-circuit protection, Thermal shutdown | -40 | 85 | SNT-6A | 16 |

| Series Name | Features | Type | Control | Transistor | VIN min. [V] | VIN max. [V] | VOUT min. [V] | VOUT max. [V] | IOUT [A] | Frequency [Hz] | ISS typ. [μA] | Istandby max. [μA] | Efficiency [%] | COUT | Protection Circuit | Operation temp. min. [°C] | Operation temp. max. [°C] | Package | Page |
|----------------|---|-----------|---------------------------|------------|--------------|--------------|---------------|---------------|----------|----------------|---------------|--------------------|----------------|---------|---|---------------------------|---------------------------|---------|------|
| S-85S1P | Ultra-efficient, Synchronous, Supply voltage divided output | Step-down | PWM/PFM switching control | Built-in | 2.2 | 5.5 | 0.70 | 3.9 | 0.20 | 1000k | 0.54 | 0.1 | 93 | Ceramic | Current limit, Short-circuit protection, Thermal shutdown | -40 | 85 | SNT-8A | 17 |
| S-85V1A | Efficient, Synchronous | Step-down | PWM/PFM switching control | Built-in | 2.2 | 5.5 | 0.70 | 3.9 | 0.20 | 1000k | 10.0 | 0.1 | 93 | Ceramic | Current limit, Short-circuit protection, Thermal shutdown | -40 | 85 | SNT-6A | 18 |

Boost Charge Pump ICs

[Boost Charge Pump ICs on ablic.com](#)

| Series Name | Features | Transistor | VIN min. [V] | VIN max. [V] | VOUT min. [V] | VOUT max. [V] | IOUT [mA] | Frequency [kHz] | ISS typ. [μA] | Istandby max. [μA] | Efficiency [%] | Operation temp. min. [°C] | Operation temp. max. [°C] | Package | Page |
|---------------|--------------------------------|------------|--------------|--------------|---------------|---------------|-----------|-----------------|---------------|--------------------|----------------|---------------------------|---------------------------|-------------------|------|
| S-8821 | Double boost, Constant voltage | Built-in | 1.6 | 5.0 | 2.5 | 5.5 | 25 | 1000 | 35 | 1 | 90 | -40 | 85 | SOT-23-6W, SNT-8A | 19 |

Power Sequencer

[Power Sequencer on ablic.com](#)

| Series Name | Enable output | Order of enable output | Disable trigger input pin | Current consumption [μA] | Operation temp. min. [°C] | Operation temp. max. [°C] | Package | Page |
|----------------------|------------------------|----------------------------|---------------------------|--------------------------|---------------------------|---------------------------|---------------------|------|
| S-77100/77101 | 3 channels, 4 channels | Reverse type, Forward type | Selectable | 3.0 | -40 | 85 | 8-Pin TSSOP, SNT-8A | 20 |

S-8333 Series

STEP-UP, FOR LCD BIAS SUPPLY, 1-CHANNEL, PWM CONTROL SWITCHING REGULATOR CONTROLLER

The S-8333 Series is a CMOS step-up switching regulator which mainly consists of a reference voltage circuit, an oscillator, an error amplifier, a PWM controller, an under voltage lockout circuit (UVLO), and a timer latch short-circuit protection circuit. Because its minimum operating voltage is as low as 1.8 V, this switching regulator is ideal for the power supply of an LCD or for portable systems that operate on a low voltage. The internal oscillation frequency can be set up to 1.08 MHz, via the resistor connected to the ROSC pin.

The maximum duty ratio of PWM control can be controlled by the resistor connected to the RDuty pin. The soft-start function at power application is accomplished by combining the reference voltage control and maximum duty control methods. Even if the voltage of the FB pin is retained lower than the reference voltage due to the factor outside the IC, the output voltage is raised by controlling the maximum duty. The phase compensation and gain value can be adjusted according to the values of the resistor and capacitor connected to the CC pin. Therefore, the operation stability and transient response can be correctly set for each application. The reference voltage accuracy is as high as $1.0\text{ V} \pm 1.5\%$, and any voltage can be output by using an external output voltage setting resistor.

In addition, the delay time of the short-circuit protection circuit can be set by using the capacitor connected to the CSP pin. If the maximum duty condition continues because of short-circuiting, the capacitor externally connected to the CSP pin is charged, and oscillation stops after a specific time. The short-circuit protection function is cancelled when the power supply is raised to the UVLO release voltage after it has been lowered to the UVLO detection voltage. A ceramic capacitor or a tantalum capacitor is used as the output capacitor, depending on the setting. This controller IC allows various settings and selections and employs a small package, making it very easy to use.

■ Features

- Low voltage operation: 1.8 V to 6.0 V
- Oscillation frequency: 280 kHz to 1.08 MHz (selectable by external resistor)
- Maximum duty: Settable up to 88.5% by external resistor
47 to 88.5% (oscillation frequency; 500 kHz or more)
47 to 80% (oscillation frequency; less than 500 kHz)
- Reference voltage: $1.0\text{ V} \pm 1.5\%$
- Range of operation temperature: -40 to $+85^\circ\text{C}$
- UVLO (under-voltage lockout) function:
 - Detection voltage can be selected from between 1.5 V and 2.3 V in 0.1 V step.
 - Hysteresis width can be selected from between 0.1 V and 0.3 V in 0.1 V step.
- Timer latch short-circuit protection circuit:
 - Delay time can be set using an external capacitor.
- Soft-start function:
 - Soft-start time can be selected in three steps, 10 ms, 15 ms, and 20 ms.
 - Both reference voltage control and maximum duty control methods are applied
- Phase compensation external setting:
 - Control is possible via the resistor connected between the CC and GND pins and capacitor
- Lead-free, Sn 100%, halogen-free^{*1}

*1. Refer to “■ Product Name Structure” for details.

■ Applications

- Power supplies for LCDs and CCDs
- Power supplies for portable equipment

■ Packages

- SNT-8A
- 8-Pin TSSOP

S-8337/8338 Series

STEP-UP, 1.2 MHz HIGH-FREQUENCY, PWM CONTROL SWITCHING REGULATOR CONTROLLER

The S-8337/8338 Series is a CMOS step-up switching regulator which mainly consists of a reference voltage circuit, an oscillator, an error amplifier, a PWM controller, an under voltage lockout circuit (UVLO), and a timer latch short-circuit protection circuit. Because its minimum operating voltage is as low as 1.8 V, this switching regulator is ideal for the power supply of an LCD or for portable systems that operate on a low voltage. The internal oscillation frequency can be set up to 1.133 MHz, via the resistor connected to the ROSC pin.

With the S-8337 Series, the maximum duty ratio of PWM control can be controlled by the resistor connected to the RDuty pin. With the S-8338 Series, the maximum duty ratio is fixed (to 88%). The phase compensation and gain value can be adjusted according to the values of the resistor and capacitor connected to the CC pin. Therefore, the operation stability and transient response can be correctly set for each application. The reference voltage accuracy is as high as $1.0\text{ V} \pm 1.5\%$, and any voltage can be output by using an external output voltage setting resistor.

In addition, the delay time of the short-circuit protection circuit can be set by using the capacitor connected to the CSP pin. If the maximum duty condition continues because of short-circuiting, the capacitor externally connected to the CSP pin is charged, and oscillation stops after a specific time. This condition is cleared by re-application of power or by setting the switching regulator (S-8338 Series) to the shutdown status. A ceramic capacitor or a tantalum capacitor is used as the output capacitor, depending on the setting. This controller IC allows various settings and selections and employs a small package, making it very easy to use.

■ Features

- Low voltage operation: 1.8 V to 6.0 V
- Oscillation frequency: 286 kHz to 1.133 MHz (selectable by external resistor)
- Maximum duty: 47 to 88.5% (selectable by external resistor) (S-8337 Series)
Fixed to 88% typ. (S-8338 Series)
- Reference voltage: $1.0\text{ V} \pm 1.5\%$
- UVLO (under-voltage lockout) function:
Detection voltage can be selected from between 1.5 V and 2.3 V in 0.1 V steps.
Hysteresis width can be selected from between 0.1 V and 0.3 V in 0.1 V steps.
- Timer latch short-circuit protection circuit:
Delay time can be set using an external capacitor.
- Soft-start function: Soft-start time can be selected in three steps, 10 ms, 15 ms, and 20 ms.
- Phase compensation external setting:
Adjustable by connecting resistor and capacitor in series to GND.
- Shutdown function: S-8338 Series, shutdown current consumption: 1.0 μA max.
- Lead-free, Sn 100%, halogen-free*1

*1. Refer to “■ Product Name Structure” for details.

■ Applications

- Power supplies for LCDs and CCDs
- Power supplies for portable equipment

■ Package

- 8-Pin TSSOP

S-8351/8352 Series

STEP-UP, BUILT-IN / EXTERNAL FET PFM CONTROL SWITCHING REGULATOR / SWITCHING REGULATOR CONTROLLER

The S-8351/8352 Series is a CMOS step-up switching regulator controller which mainly consists of a reference voltage source, an oscillation circuit, a comparator and PFM control circuit. The PFM control circuit allows the duty ratio to be automatically switched according to the load (at light load : 50%, at high output current : 75%), enabling products with a low ripple over a wide range, high efficiency, and high output current (A, B, and D type). Products with a fixed duty ratio of 75% are also available (C type).

The S-8351 Series can configure a step-up switching regulator with an external coil, capacitor, and diode. A protection circuit turns off the built-in MOS FET when the voltage at the CONT pin exceeds the limit to prevent it from being damaged. In addition to the above features, the small package and low current consumption, makes the S-8351 Series ideal for applications such as the power supply unit of portable equipment.

The S-8352 Series, which features an external transistor, is suitable for applications requiring a high output current.

■ Features

- Low voltage operation : Startup at 0.9 V min. ($I_{OUT} = 1$ mA) guaranteed
- Low current consumption : During operation 23.2 μ A ($V_{OUT} = 3.3$ V, typ.)
During shutdown 0.5 μ A (max.)
- Duty ratio : 50 % / 75 % built-in auto-switching-type PFM control circuit (A, B, and D type)
75 % built-in fixed-type PFM control circuit (C type)
- External parts : Coil, capacitor, and diode
- Output voltage : Selectable in 0.1 V steps between 2.0 V to 6.5 V (A, B, and C type)
Selectable in 0.1 V steps between 1.5 V to 6.5 V (D type)
- Output voltage accuracy : $\pm 2.4\%$
- Shutdown function (A type)
- V_{DD} / V_{OUT} separate type (D type)
- External transistor type available (S-8352 Series)
- Lead-free, Sn 100%, halogen-free^{*1}

*1. Refer to "■ Product Name Structure" for details.

■ Applications

- Power supplies for portable equipment such as digital cameras, electronic notebooks, and PDAs
- Power supplies for audio equipment such as portable CD / MD players
- Constant voltage power supplies for cameras, video equipment, and communications equipment
- Power supplies for microcomputers

■ Packages

- SOT-23-3
- SOT-23-5
- SOT-89-3

S-8353/8354 Series

STEP-UP, PWM CONTROL or PWM / PFM SWITCHABLE

BUILT-IN TRANSISTOR SWITCHING REGULATOR

The S-8353/8354 Series is a CMOS step-up switching regulator which mainly consists of a reference voltage source, an oscillation circuit, a power MOS FET, an error amplifier, a phase compensation circuit, a PWM control circuit (S-8353 Series) and a PWM / PFM switching control circuit (S-8354 Series).

The S-8353/8354 Series can configure the step-up switching regulator with an external coil, capacitor, and diode. In addition to the above features, the small package and low current consumption make the S-8353/8354 Series ideal for portable equipment applications requiring high efficiency.

The S-8353 Series realizes low ripple, high efficiency, and excellent transient characteristics due to its PWM control circuit whose duty ratio can be varied linearly from 0% to 83% (from 0% to 78% for 250 kHz models), an excellently designed error amplifier, and phase compensation circuits.

The S-8354 Series features a PWM / PFM switching controller that can switch the operation to a PFM controller with a duty ratio is 15% under a light load to prevent a decline in the efficiency due to the IC operating current.

■ Features

- Low voltage operation: Startup at 0.9 V min. ($I_{OUT} = 1$ mA) guaranteed
- Low current consumption : During operation 18.7 μ A (3.3 V, 50 kHz, typ.)
During shutdown: 0.5 μ A (max.)
- Duty ratio : Built-in PWM / PFM switching control circuit (S-8354 Series)
15 % to 83 % (30 kHz and 50 kHz models)
15 % to 78 % (250 kHz models)
- External parts : Coil, capacitor, and diode
- Output voltage : Selectable in 0.1 V steps between 1.5 V and 6.5 V (for V_{DD} / V_{OUT} separate types)
Selectable in 0.1 V steps between 2.0 V and 6.5 V (for other than V_{DD} / V_{OUT} separate types)
- Output voltage accuracy : $\pm 2.4\%$
- Oscillation frequency : 30 kHz, 50 kHz, and 250 kHz selectable
- Soft start function : 6 ms (50 kHz, typ.)
- Lead-free, Sn 100%, halogen-free*1

*1. Refer to “■ Product Name Structure” for details.

■ Applications

- Power supplies for portable equipment such as digital cameras, electronic notebooks, and PDAs
- Power supplies for audio equipment such as portable CD / MD players
- Constant voltage power supplies for cameras, VCRs, and communication devices
- Power supplies for microcomputers

■ Packages

- SOT-23-3
- SOT-23-5
- SOT-89-3

S-8355/56/57/58 Series

STEP-UP, SUPER-SMALL PACKAGE, 600 kHz, PWM CONTROL or PWM/PFM SWITCHABLE SWITCHING REGULATOR CONTROLLER

The S-8355/56/57/58 Series is a CMOS step-up switching regulator controller which mainly consists of a reference voltage source, an oscillation circuit, an error amplifier, a phase compensation circuit, a PWM control circuit (S-8355/57 Series) and a PWM/PFM switching control circuit (S-8356/58 Series).

With an external low-ON-resistance Nch Power MOS, this product is ideal for applications requiring high efficiency and a high output current.

The S-8355/57 Series realizes low ripple, high efficiency, and excellent transient characteristics due to its PWM control circuit whose duty ratio can be varied linearly from 0 to 83% (from 0 to 78% for 250 kHz, 300 kHz, and 600 kHz models), an excellently designed error amplifier and a phase compensation circuits.

S-8356/58 Series features a PWM/PFM switching controller that can switch the operation to a PFM controller with a duty ratio is 15% under a light load to prevent a decline in the efficiency due to the IC operating current.

■ Features

- Low voltage operation : Startup at 0.9 V min. ($I_{OUT} = 1$ mA) guaranteed
- Low current consumption : During operation 25.9 μ A (3.3 V, 100 kHz, typ.)
During shutdown 0.5 μ A (max.)
- Duty ratio : Built-in PWM/PFM switching control circuit (S-8356/58 Series)
15 to 83% (100 kHz models)
15 to 78% (250 kHz, 300 kHz, and 600 kHz models)
- External parts : Coil, diode, capacitor, and transistor
- Output voltage : Selectable in 0.1 V steps between 1.5 and 6.5 V (for V_{DD} / V_{OUT} separate types)
Selectable in 0.1 V steps between 2.0 and 6.5 V (for other than V_{DD} / V_{OUT} separate types)
- Output voltage accuracy : $\pm 2.4\%$
- Oscillation frequency : 100 kHz, 250 kHz, 300 kHz, 600 kHz selectable
- Soft start function : 6 ms (100 kHz, typ.)
- Shutdown function
- Lead-free, Sn 100%, halogen-free^{*1}

*1. Refer to "■ Product Name Structure" for details.

■ Applications

- Power supplies for portable equipment such as digital cameras, electronic notebooks, and PDAs
- Power supplies for audio equipment such as portable CD / MD players
- Constant voltage power supplies for cameras, VCRs, and communications devices
- Power supplies for microcomputers

■ Packages

- SOT-23-3
- SOT-23-5
- SOT-89-3

S-8520/8521 Series

STEP-DOWN, PWM CONTROL or PWM / PFM SWITCHABLE SWITCHING REGULATOR CONTROLLER

The S-8520/8521 Series is a CMOS step-down switching regulator-controller with PWM control (S-8520 Series) and PWM / PFM switching control (S-8521 Series). The S-8520/8521 Series has a reference voltage source, an oscillation circuit, an error amplifier, and other components.

The S-8520 Series provides low-ripple power, high efficiency, and excellent transient characteristics due to a PWM control circuit capable of varying the duty ratio linearly from 0% up to 100%. The S-8520/8521 Series also has a soft-start circuit that prevents overshoot at startup.

The S-8521 Series works with either PWM control or PFM control. It normally operates using PWM control with a duty ratio of 25% to 100%, but under a light load, it automatically switches to PFM control with a duty ratio of 25%. The S-8520/8521 Series ensures high efficiency over a wide range of conditions for devices, from the standby mode to the operation.

By adding external Pch power MOS FET or PNP transistor, coil, capacitor, and externally connected diode, the S-8520/8521 Series can function as a step-down switching regulator, and is ideal for power supply units of portable devices due to small SOT-23-5 and the feature of low current consumption. It is also ideal for AC adapters due to the input voltage up to 16 V.

■ Features

- Low current consumption

| | |
|-------------------|-------------------------------|
| During operation: | 60 μ A max. (A, B types) |
| | 21 μ A max. (C, D types) |
| | 100 μ A max. (E, F types) |
| During shutdown: | 0.5 μ A max. |
- Input voltage:

| |
|-------------------------------|
| 2.5 V to 16 V (B, D, F types) |
| 2.5 V to 10 V (A, C, E types) |
- Output voltage: Selectable between 1.5 V and 6.0 V in 0.1 V step
- Duty ratio:

| |
|---|
| 0% to 100% PWM control (S-8520 Series) |
| 25% to 100% PWM / PFM switching control (S-8521 Series) |
- External parts are Pch power MOS FET or PNP transistor, coil, diode, and capacitor only
(When using PNP transistor, add base resistor and capacitor).
- Oscillation frequency:

| |
|---------------------------|
| 180 kHz typ. (A, B types) |
| 60 kHz typ. (C, D types) |
| 300 kHz typ. (E, F types) |
- Soft-start function:

| |
|---------------------------|
| 8 ms. typ. (A, B types) |
| 12 ms. typ. (C, D types) |
| 4.5 ms. typ. (E, F types) |
- With a shutdown function
- With a built-in overload protection circuit

| | |
|--------------------------|-----------------------|
| Overload detection time: | 4 ms. typ. (A type) |
| | 14 ms. typ. (C type) |
| | 2.6 ms. typ. (E type) |
- Lead-free, Sn 100%, halogen-free^{*1}

*1. Refer to "■ Product Name Structure" for details.

S-8533 Series

STEP-DOWN, SYNCHRONOUS PWM CONTROL SWITCHING REGULATOR CONTROLLER

The S-8533 Series is a synchronous PWM control CMOS step-down switching regulator controller that includes a reference voltage source, synchronous circuit, oscillation circuit, error amplifier, phase compensation circuit, and PWM controller.

An efficient step-down switching regulator can be realized simply by adding external P-channel and N-channel power MOS FETs, one coil, and three capacitors.

Since the oscillation frequency is a high 300 kHz, the S-8533 can be used to configure a high efficiency step-down switching regulator capable of driving high output current using small external parts and a 3 to 10% increase in efficiency is obtained compared to conventional step-down switching regulators.

The 8-Pin TSSOP package and high oscillation frequency make the S-8533 ideal as the main power supply for portable devices.

■ Features

- Synchronous rectification system realizing high efficiency (typ. 94%)
- Use at maximum duty ratio = 100% and use of a battery up to maximum life is possible by using P-channel and N-channel power MOS FETs externally.
- Oscillation frequency : 300 kHz typ.
- Input voltage : 2.7 to 16.0 V
- Output voltage : 1.25 V
1.3 to 6.0 V, selectable in 0.1 V steps
- Output voltage accuracy : $\pm 2.0\%$
- Soft-start function set by an external capacitor (C_{SS})
- Shutdown function
- Lead-free, Sn 100%, halogen-free*1

*1. Refer to “■ Product Name Structure” for details.

■ Applications

- Constant voltage power supply for hard disks and DVD drivers
- Power supplies for portable devices, such as digital cameras, PDAs, electronic organizers, and cellular phones
- Main or sub power supply for notebook PCs and peripherals
- Constant voltage power supply for cameras, video equipment, and communication equipment

■ Package

- 8-Pin TSSOP

S-8580AA/8580AB/8581AA/8581AB Series

36 V INPUT, 600 mA SYNCHRONOUS STEP-DOWN SWITCHING REGULATOR

The S-8580/8581 Series is a step-down switching regulator developed using high withstand voltage CMOS process technologies.

This IC has high maximum operation voltage of 36 V and maintains high-accuracy FB pin voltage at $\pm 1.5\%$. As suitable packages for high-density mounting, such as small-sized HSNT-6(2025), are adopted, this IC contributes to miniaturization of electronic equipment.

PWM control (S-8580 Series) or PWM / PFM switching control (S-8581 Series) can be selected as an option.

Since the S-8581 Series, which features PWM / PFM switching control, operates with PWM control under heavy load and automatically switches to PFM control under light load, it achieves high-efficiency operation in accordance with the device's status. Furthermore, our distinctive PWM / PFM switching control technology suppresses the ripple voltage to be generated in V_{OUT} while PFM control is in operation.

Since the S-8580/8581 Series has the built-in synchronous circuit, it achieves high efficiency easier compared with conventional step-down switching regulators. In addition, it has the built-in overcurrent protection circuit which protects the IC and coils from excessive load current as well as a thermal shutdown circuit which prevents damage from heat generation.

■ Features

- Input voltage: 4.0 V to 36.0 V
- Output voltage (externally set): 2.5 V to 30.0 V (S-8580 Series)
2.5 V to 12.0 V (S-8581 Series)
- Output current: 600 mA
- FB pin voltage accuracy: $\pm 1.5\%$
- Efficiency: 91%
- Oscillation frequency: 2.2 MHz typ.
- Overcurrent protection function: 1.2 A typ. (pulse-by-pulse method)
- Thermal shutdown function: 170°C typ. (detection temperature)
- Short-circuit protection function: Hiccup control, Latch control
- 100% duty cycle operation:
- Soft-start function: 5.8 ms typ.
- Under voltage lockout function (UVLO): 3.35 V typ. (detection voltage)
- Input and output capacitors: Ceramic capacitor compatible
- Operation temperature range: $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$
- Lead-free (Sn 100%), halogen-free

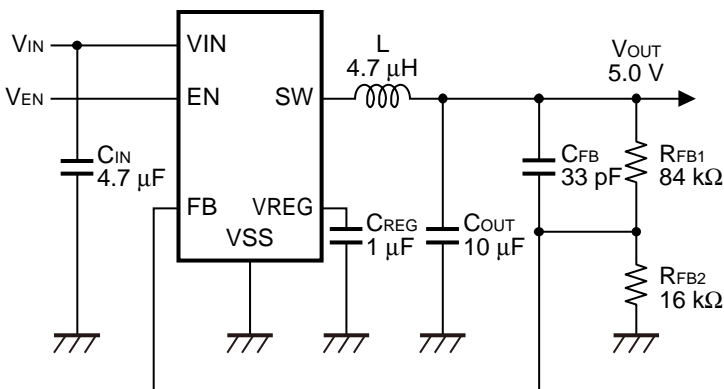
■ Applications

- Constant-voltage power supply for industrial equipment
- Constant-voltage power supply for home electric appliance

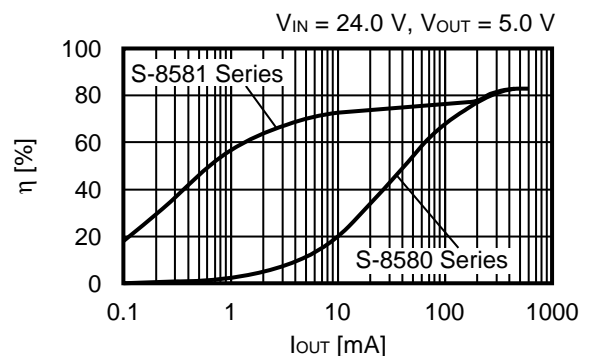
■ Packages

- HTMSOP-8 (4.0 mm \times 2.9 mm \times t0.8 mm max.)
- HSNT-8(2030) (3.0 mm \times 2.0 mm \times t0.5 mm max.)
- HSNT-6(2025) (2.46 mm \times 1.96 mm \times t0.5 mm max.)

■ Typical Application Circuit



■ Efficiency



S-8580AC/8580AD/8581AC/8581AD Series

36 V INPUT, 600 mA SYNCHRONOUS STEP-DOWN SWITCHING REGULATOR

The S-8580/8581 Series is a step-down switching regulator developed using high withstand voltage CMOS process technologies.

This IC has high maximum operation voltage of 36 V and maintains high-accuracy FB pin voltage at $\pm 1.5\%$. As suitable packages for high-density mounting, such as small-sized HSNT-6(2025), are adopted, this IC contributes to miniaturization of electronic equipment.

PWM control (S-8580 Series) or PWM / PFM switching control (S-8581 Series) can be selected as an option.

Since the S-8581 Series, which features PWM / PFM switching control, operates with PWM control under heavy load and automatically switches to PFM control under light load, it achieves high-efficiency operation in accordance with the device's status. Furthermore, our distinctive PWM / PFM switching control technology suppresses the ripple voltage to be generated in V_{OUT} while PFM control is in operation.

Since the S-8580/8581 Series has the built-in synchronous circuit, it achieves high efficiency easier compared with conventional step-down switching regulators. In addition, it has the built-in overcurrent protection circuit which protects the IC and coils from excessive load current as well as a thermal shutdown circuit which prevents damage from heat generation.

■ Features

- Input voltage: 4.0 V to 36.0 V
- Output voltage (externally set): 2.5 V to 12.0 V
- Output current: 600 mA
- FB pin voltage accuracy: $\pm 1.5\%$
- Efficiency: 95%
- Oscillation frequency: 400 kHz typ.
- Overcurrent protection function: 1.2 A typ. (pulse-by-pulse method)
- Thermal shutdown function: 170°C typ. (detection temperature)
- Short-circuit protection function: Hiccup control, Latch control
- 100% duty cycle operation:
- Soft-start function: 5.8 ms typ.
- Under voltage lockout function (UVLO): 3.35 V typ. (detection voltage)
- Input and output capacitors: Ceramic capacitor compatible
- Operation temperature range: $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$
- Lead-free (Sn 100%), halogen-free

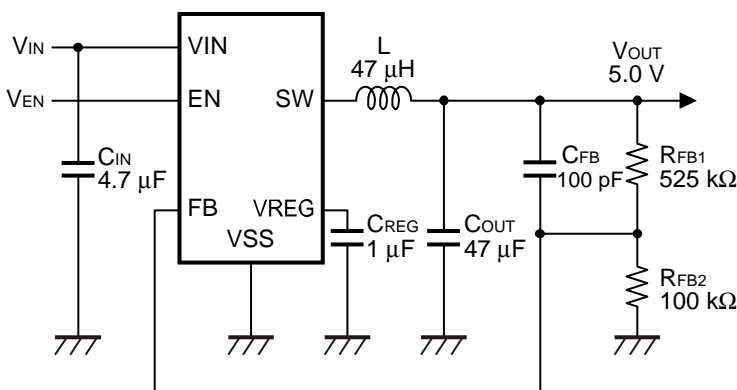
■ Applications

- Constant-voltage power supply for industrial equipment
- Constant-voltage power supply for home electric appliance

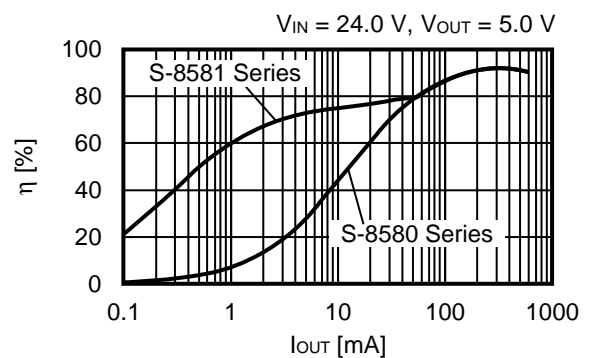
■ Packages

- HTMSOP-8 (4.0 mm \times 2.9 mm \times t0.8 mm max.)
- HSNT-8(2030) (3.0 mm \times 2.0 mm \times t0.5 mm max.)
- HSNT-6(2025) (2.46 mm \times 1.96 mm \times t0.5 mm max.)

■ Typical Application Circuit



■ Efficiency



S-8590AA/8590AB/8591AA/8591AB Series

18 V INPUT, 600 mA SYNCHRONOUS STEP-DOWN SWITCHING REGULATOR

The S-8590/8591 Series is a step-down switching regulator developed using high withstand voltage CMOS process technologies.

This IC has high maximum operation voltage of 18 V and maintains high-accuracy FB pin voltage at $\pm 1.5\%$. As suitable packages for high-density mounting, such as small-sized HSNT-6(2025), are adopted, this IC contributes to miniaturization of electronic equipment.

PWM control (S-8590 Series) or PWM / PFM switching control (S-8591 Series) can be selected as an option.

Since the S-8591 Series, which features PWM / PFM switching control, operates with PWM control under heavy load and automatically switches to PFM control under light load, it achieves high-efficiency operation in accordance with the device's status. Furthermore, our distinctive PWM / PFM switching control technology suppresses the ripple voltage to be generated in V_{OUT} while PFM control is in operation.

Since the S-8590/8591 Series has the built-in synchronous circuit, it achieves high efficiency easier compared with conventional step-down switching regulators. In addition, it has the built-in overcurrent protection circuit which protects the IC and coils from excessive load current as well as a thermal shutdown circuit which prevents damage from heat generation.

■ Features

- Input voltage: 4.0 V to 18.0 V
- Output voltage (externally set): 1.0 V to 12.0 V
- Output current: 600 mA
- FB pin voltage accuracy: $\pm 1.5\%$
- Efficiency: 91%
- Oscillation frequency: 2.2 MHz typ.
- Overcurrent protection function: 1.2 A typ. (pulse-by-pulse method)
- Thermal shutdown function: 170°C typ. (detection temperature)
- Short-circuit protection function: Hiccup control, Latch control
- 100% duty cycle operation:
- Soft-start function: 5.8 ms typ.
- Under voltage lockout function (UVLO): 3.35 V typ. (detection voltage)
- Input and output capacitors: Ceramic capacitor compatible
- Operation temperature range: $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$
- Lead-free (Sn 100%), halogen-free

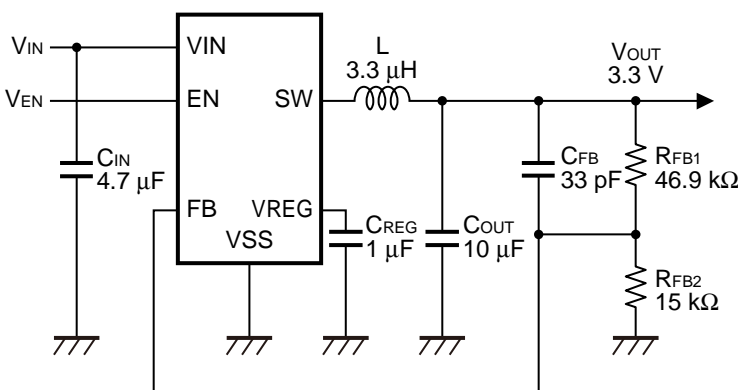
■ Applications

- Constant-voltage power supply for industrial equipment
- Constant-voltage power supply for home electric appliance

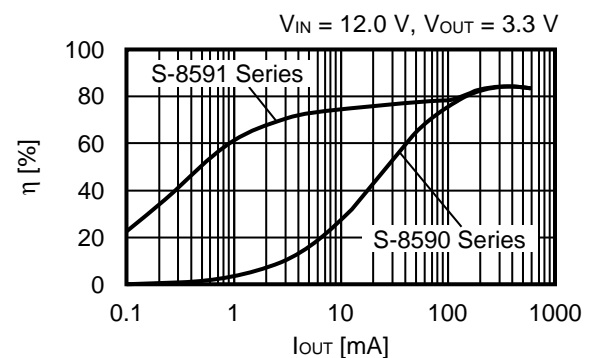
■ Packages

- HTMSOP-8 (4.0 mm \times 2.9 mm \times t0.8 mm max.)
- HSNT-8(2030) (3.0 mm \times 2.0 mm \times t0.5 mm max.)
- HSNT-6(2025) (2.46 mm \times 1.96 mm \times t0.5 mm max.)

■ Typical Application Circuit



■ Efficiency



S-8590AC/8590AD/8591AC/8591AD Series

18 V INPUT, 600 mA SYNCHRONOUS STEP-DOWN SWITCHING REGULATOR

The S-8590/8591 Series is a step-down switching regulator developed using high withstand voltage CMOS process technologies.

This IC has high maximum operation voltage of 18 V and maintains high-accuracy FB pin voltage at $\pm 1.5\%$. As suitable packages for high-density mounting, such as small-sized HSNT-6(2025), are adopted, this IC contributes to miniaturization of electronic equipment.

PWM control (S-8590 Series) or PWM / PFM switching control (S-8591 Series) can be selected as an option.

Since the S-8591 Series, which features PWM / PFM switching control, operates with PWM control under heavy load and automatically switches to PFM control under light load, it achieves high-efficiency operation in accordance with the device's status. Furthermore, our distinctive PWM / PFM switching control technology suppresses the ripple voltage to be generated in V_{OUT} while PFM control is in operation.

Since the S-8590/8591 Series has the built-in synchronous circuit, it achieves high efficiency easier compared with conventional step-down switching regulators. In addition, it has the built-in overcurrent protection circuit which protects the IC and coils from excessive load current as well as a thermal shutdown circuit which prevents damage from heat generation.

■ Features

- Input voltage: 4.0 V to 18.0 V
- Output voltage (externally set): 2.5 V to 12.0 V
- Output current: 600 mA
- FB pin voltage accuracy: $\pm 1.5\%$
- Efficiency: 95%
- Oscillation frequency: 400 kHz typ.
- Overcurrent protection function: 1.2 A typ. (pulse-by-pulse method)
- Thermal shutdown function: 170°C typ. (detection temperature)
- Short-circuit protection function: Hiccup control, Latch control
- 100% duty cycle operation:
- Soft-start function: 5.8 ms typ.
- Under voltage lockout function (UVLO): 3.35 V typ. (detection voltage)
- Input and output capacitors: Ceramic capacitor compatible
- Operation temperature range: $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$
- Lead-free (Sn 100%), halogen-free

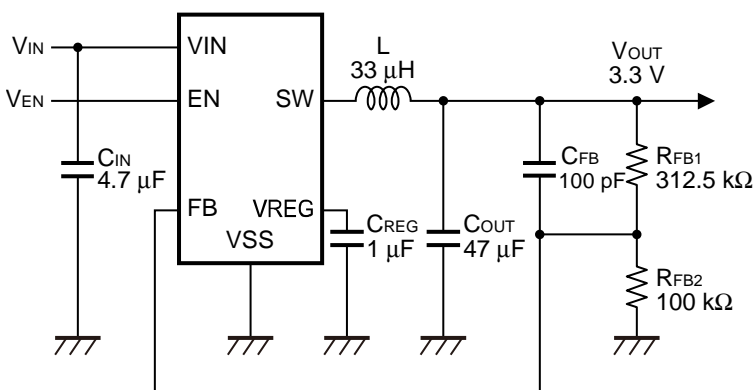
■ Applications

- Constant-voltage power supply for industrial equipment
- Constant-voltage power supply for home electric appliance

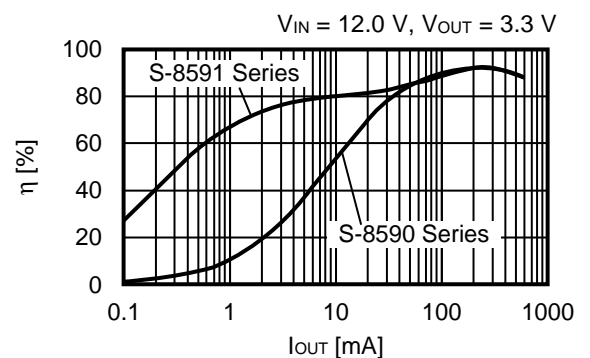
■ Packages

- HTMSOP-8 (4.0 mm \times 2.9 mm \times t0.8 mm max.)
- HSNT-8(2030) (3.0 mm \times 2.0 mm \times t0.5 mm max.)
- HSNT-6(2025) (2.46 mm \times 1.96 mm \times t0.5 mm max.)

■ Typical Application Circuit



■ Efficiency



S-85M0A Series (WLP product)

5.6 V INPUT, 50 mA, LOW EMI, SYNCHRONOUS STEP-DOWN SWITCHING REGULATOR WITH 260 nA QUIESCENT CURRENT

The S-85M0A Series introduces own distinctive low power consumption control and COT (Constant On-Time) control, features ultra low current consumption (260 nA quiescent current) and fast transient response, operates at PFM control. The S-85M0A Series realizes high efficiency in a wide range of load current consumption and provides strong support for extended period operation of mobile devices and wearable devices which are equipped with compact batteries.

In addition, WLP-6L package suitable for high-density mounting is adopted, it contributes to miniaturization of electronic equipment. By using external parts recommended in this datasheet, the occupancy area can be reduced to $1.6 \text{ mm} \times 2.7 \text{ mm} = 4.3 \text{ mm}^2$.

Since the S-85M0A Series suppressing EMI emission minimally, allows for high efficiency, it is adequate for applications such as wireless communication, GPS and other noise-affected devices.

■ Features

- Ultra low current consumption: 260 nA quiescent current
- Efficiency (when under 100 μA load): 90.5%
- Fast transient response: COT control
- Input voltage: 2.2 V to 5.6 V
- Output voltage: 0.7 V to 2.5 V, in 0.05 V step
2.6 V to 3.9 V, in 0.1 V step
- Output voltage accuracy: $\pm 1.5\%$ ($1.0 \text{ V} \leq V_{\text{OUT}} \leq 3.9 \text{ V}$)
 $\pm 15 \text{ mV}$ ($0.7 \text{ V} \leq V_{\text{OUT}} < 1.0 \text{ V}$)
- High side power MOS FET on-resistance: 360 m Ω
- Low side power MOS FET on-resistance: 250 m Ω
- Soft-start function: 1 ms typ.
- Under voltage lockout function (UVLO): 1.8 V typ. (detection voltage)
- Thermal shutdown function: 135°C typ. (detection temperature)
- Overcurrent protection function: 300 mA (at L = 2.2 μH)
- Automatic recovery type short-circuit protection function: Hiccup control
- Discharge shunt function: Unavailable
(S-85M0A Series B type)
Available
(S-85M0A Series C type)
- Input and output capacitors: Ceramic capacitor compatible
- Operation temperature range: $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$
- Lead-free, halogen-free

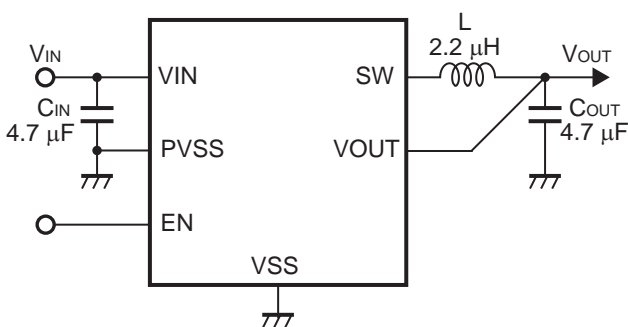
■ Applications

- Wearable device
- Bluetooth device
- Wireless sensor network device
- Healthcare equipment
- Smart meter
- Portable game device
- GPS device

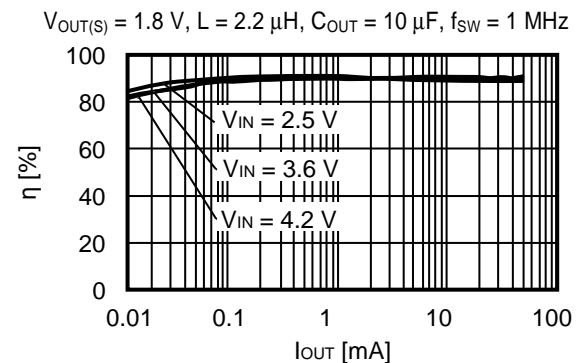
■ Package

- WLP-6L
(1.25 mm \times 0.79 mm \times t0.55 mm max.)

■ Typical Application Circuit



■ Efficiency



S-85M1A Series (WLP product)

5.6 V INPUT, 200 mA, LOW EMI, SYNCHRONOUS STEP-DOWN SWITCHING REGULATOR WITH 260 nA QUIESCENT CURRENT

The S-85M1A Series introduces own distinctive low power consumption control and COT (Constant On-Time) control and features ultra low current consumption and fast transient response. PWM / PFM switching control automatically switches to PFM control when under light load, and the IC operates at ultra low current consumption of 260 nA quiescent current. The S-85M1A Series realizes high efficiency in a wide range of load current consumption and provides strong support for extended period operation of mobile devices and wearable devices which are equipped with compact batteries.

In addition, WLP-6L package suitable for high-density mounting is adopted, it contributes to miniaturization of electronic equipment. By using external parts recommended in this datasheet, the occupancy area can be reduced to $2.0 \text{ mm} \times 3.3 \text{ mm} = 6.6 \text{ mm}^2$.

Since the S-85M1A Series suppressing EMI emission minimally, allows for high efficiency, it is adequate for applications such as wireless communication, GPS and other noise-affected devices.

■ Features

- Ultra low current consumption: 260 nA quiescent current
- Efficiency (when under 100 μA load): 90.5%
- Fast transient response: COT control
- Input voltage: 2.2 V to 5.6 V
- Output voltage: 0.7 V to 2.5 V, in 0.05 V step
2.6 V to 3.9 V, in 0.1 V step
- Output voltage accuracy: $\pm 1.5\%$ ($1.0 \text{ V} \leq V_{\text{OUT}} \leq 3.9 \text{ V}$)
 $\pm 15 \text{ mV}$ ($0.7 \text{ V} \leq V_{\text{OUT}} < 1.0 \text{ V}$)
1.0 MHz (at PWM operation)
- Switching frequency: 1.0 MHz (at PWM operation)
- High side power MOS FET on-resistance: 360 m Ω
- Low side power MOS FET on-resistance: 250 m Ω
- Soft-start function: 1 ms typ.
- Under voltage lockout function (UVLO): 1.8 V typ. (detection voltage)
- Thermal shutdown function: 135°C typ. (detection temperature)
- Overcurrent protection function: 450 mA (at L = 2.2 μH)
- Automatic recovery type short-circuit protection function: Hiccup control
- Discharge shunt function: Unavailable
(S-85M1A Series B type)
Available
(S-85M1A Series C type)
- Input and output capacitors: Ceramic capacitor compatible
- Operation temperature range: $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$
- Lead-free, halogen-free

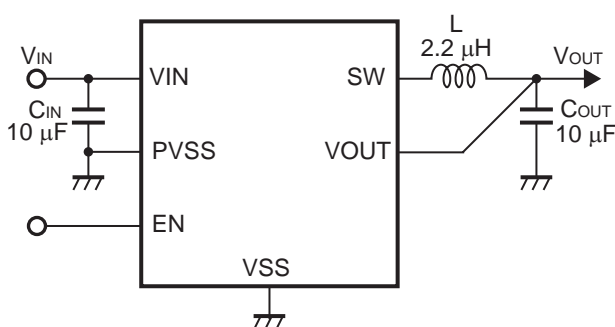
■ Applications

- Wearable device
- Bluetooth device
- Wireless sensor network device
- Healthcare equipment
- Smart meter
- Portable game device
- GPS device

■ Package

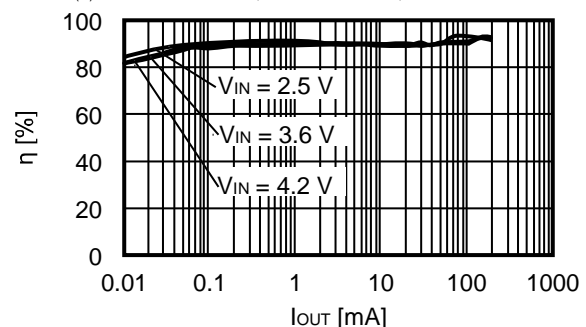
- WLP-6L
(1.25 mm \times 0.79 mm \times t0.55 mm max.)

■ Typical Application Circuit



■ Efficiency

$V_{\text{OUT(S)}} = 1.8 \text{ V}$, $L = 2.2 \mu\text{H}$, $C_{\text{OUT}} = 10 \mu\text{F}$, $f_{\text{SW}} = 1 \text{ MHz}$



S-85S0A Series

5.5 V INPUT, 50 mA SYNCHRONOUS STEP-DOWN SWITCHING REGULATOR WITH 260 nA QUIESCENT CURRENT

The S-85S0A Series introduces own distinctive low power consumption control and COT (Constant On-Time) control, features ultra low current consumption (260 nA quiescent current) and fast transient response, operates at PFM control. The S-85S0A Series realizes high efficiency in a wide range of load current consumption and provides strong support for extended period operation of mobile devices and wearable devices which are equipped with compact batteries. The S-85S0A Series can configure a step-down regulator only with a coil, an input capacitor, and an output capacitor. By using external parts recommended in this datasheet, the occupancy area can be reduced to $1.6 \text{ mm} \times 4.3 \text{ mm} = 6.9 \text{ mm}^2$, and it contributes to miniaturization of electronic equipment.

■ Features

- Ultra low current consumption: 260 nA quiescent current
- Efficiency (when under 100 μA load): 90.5%
- Fast transient response: COT control
- Input voltage: 2.2 V to 5.5 V
- Output voltage: 0.7 V to 2.5 V, in 0.05 V step
2.6 V to 3.9 V, in 0.1 V step
- Output voltage accuracy: $\pm 1.5\%$ ($1.0 \text{ V} \leq V_{\text{OUT}} \leq 3.9 \text{ V}$)
 $\pm 15 \text{ mV}$ ($0.7 \text{ V} \leq V_{\text{OUT}} < 1.0 \text{ V}$)
- High side power MOS FET on-resistance: 420 m Ω
- Low side power MOS FET on-resistance: 320 m Ω
- Soft-start function: 1 ms typ.
- Under voltage lockout function (UVLO): 1.8 V typ. (detection voltage)
- Thermal shutdown function: 135°C typ. (detection temperature)
- Overcurrent protection function: 300 mA (at L = 2.2 μH)
- Automatic recovery type short-circuit protection function: Hiccup control
- Input and output capacitors: Ceramic capacitor compatible
- Operation temperature range: $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$
- Lead-free (Sn 100%), halogen-free

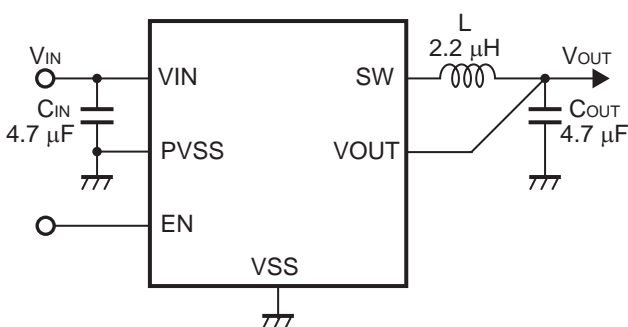
■ Applications

- Wearable device
- Bluetooth device
- Wireless sensor network device
- Healthcare equipment
- Smart meter
- Portable game device

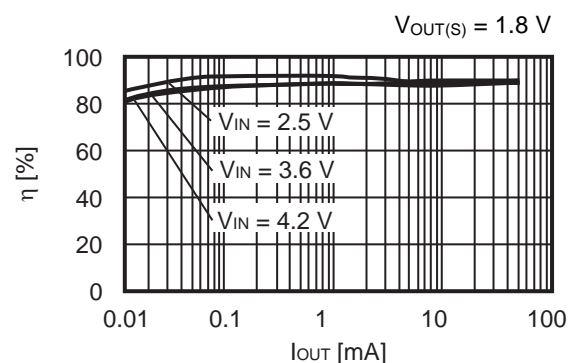
■ Package

- SNT-6A
(1.80 mm \times 1.57 mm \times t0.5 mm max.)

■ Typical Application Circuit



■ Efficiency



S-85S0P Series

SUPPLY VOLTAGE DIVIDED OUTPUT, 5.5 V INPUT, 50 mA SYNCHRONOUS STEP-DOWN SWITCHING REGULATOR WITH 260 nA QUIESCENT CURRENT

The S-85S0P Series introduces own distinctive low power consumption control and COT (Constant On-Time) control, features ultra low current consumption (260 nA quiescent current) and fast transient response, operates at PFM control. The S-85S0P Series realizes high efficiency in a wide range of load current consumption and provides strong support for extended period operation of mobile devices and wearable devices which are equipped with compact batteries.

The function of the supply voltage divided output is prepared in the S-85S0P Series. The supply voltage divided output is a function that divides the input voltage (V_{IN}) of the DC-DC converter into $V_{IN}/2$ or $V_{IN}/3$ and outputs the voltage. For example, this function makes it possible that the IC connects to a low voltage microcontroller A/D converter directly and the microcontroller monitors a battery voltage.

■ Features

DC-DC converter block

- Ultra low current consumption: 260 nA quiescent current
- Efficiency (when under 100 μ A load): 90.5%
- Fast transient response: COT control
- Input voltage: 2.2 V to 5.5 V
- Output voltage: 0.7 V to 2.5 V, in 0.05 V step
2.6 V to 3.9 V, in 0.1 V step
- Output voltage accuracy: $\pm 1.5\%$ ($1.0 \text{ V} \leq V_{OUT} \leq 3.9 \text{ V}$)
 $\pm 15 \text{ mV}$ ($0.7 \text{ V} \leq V_{OUT} < 1.0 \text{ V}$)
- High side power MOS FET on-resistance: 420 m Ω
- Low side power MOS FET on-resistance: 320 m Ω
- Soft-start function: 1 ms typ.
- Under voltage lockout function (UVLO): 1.8 V typ. (detection voltage)
- Thermal shutdown function: 135°C typ. (detection temperature)
- Overcurrent protection function: 300 mA (at L = 2.2 μ H)
- Automatic recovery type short-circuit protection function: Hiccup control
- Input and output capacitors: Ceramic capacitor compatible

Supply voltage divider block

- Low current consumption: 280 nA typ.
- Input voltage: 1.5 V to 5.5 V
- Output voltage: $V_{IN}/2$ (S-85S0PCxx)
 $V_{IN}/3$ (S-85S0PDxx)

Overall

- Operation temperature range: $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$
- Lead-free (Sn 100%), halogen-free

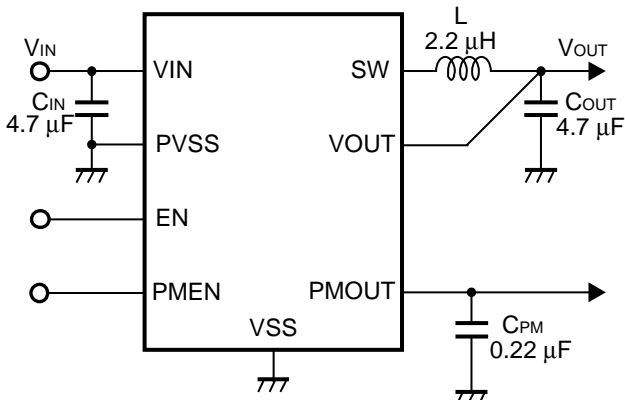
■ Applications

- Wearable device
- Bluetooth device
- Wireless sensor network device
- Healthcare equipment
- Smart meter
- Portable game device

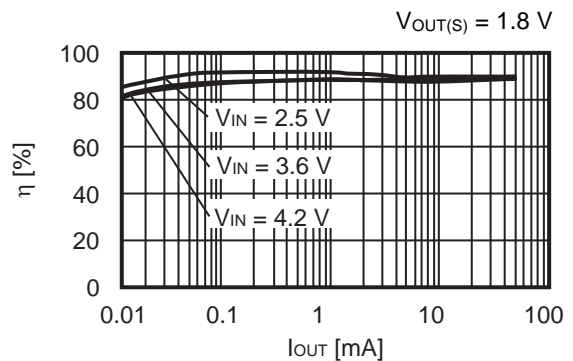
■ Package

- SNT-8A
(2.46 mm \times 1.97 mm \times t0.5 mm max.)

■ Typical Application Circuit



■ Efficiency



S-85S1A Series

5.5 V INPUT, 200 mA SYNCHRONOUS STEP-DOWN SWITCHING REGULATOR WITH 260 nA QUIESCENT CURRENT

The S-85S1A Series introduces own distinctive low power consumption control and COT (Constant On-Time) control and features ultra low current consumption and fast transient response. PWM / PFM switching control automatically switches to PFM control when under light load, and the IC operates at ultra low current consumption of 260 nA quiescent current. The S-85S1A Series realizes high efficiency in a wide range of load current consumption and provides strong support for extended period operation of mobile devices and wearable devices which are equipped with compact batteries.

The S-85S1A Series can configure a step-down regulator only with a coil, an input capacitor, and an output capacitor. By using external parts recommended in this datasheet, the occupancy area can be reduced to $2.0 \text{ mm} \times 4.5 \text{ mm} = 9.0 \text{ mm}^2$, and it contributes to miniaturization of electronic equipment.

■ Features

- Ultra low current consumption: 260 nA quiescent current
- Efficiency (when under 100 μA load): 90.5%
- Fast transient response: COT control
- Input voltage: 2.2 V to 5.5 V
- Output voltage: 0.7 V to 2.5 V, in 0.05 V step
2.6 V to 3.9 V, in 0.1 V step
- Output voltage accuracy: $\pm 1.5\%$ ($1.0 \text{ V} \leq V_{\text{OUT}} \leq 3.9 \text{ V}$)
 $\pm 15 \text{ mV}$ ($0.7 \text{ V} \leq V_{\text{OUT}} < 1.0 \text{ V}$)
- Switching frequency: 1.0 MHz (at PWM operation)
- High side power MOS FET on-resistance: 420 m Ω
- Low side power MOS FET on-resistance: 320 m Ω
- Soft-start function: 1 ms typ.
- Under voltage lockout function (UVLO): 1.8 V typ. (detection voltage)
- Thermal shutdown function: 135°C typ. (detection temperature)
- Overcurrent protection function: 450 mA (at $L = 2.2 \mu\text{H}$)
- Automatic recovery type short-circuit protection function: Hiccup control
- Input and output capacitors: Ceramic capacitor compatible
- Operation temperature range: $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$
- Lead-free (Sn 100%), halogen-free

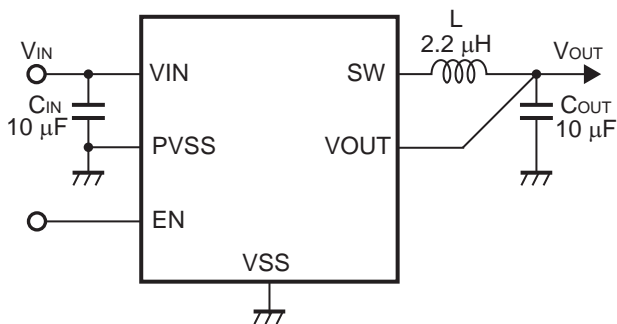
■ Applications

- Wearable device
- Bluetooth device
- Wireless sensor network device
- Healthcare equipment
- Smart meter
- Portable game device

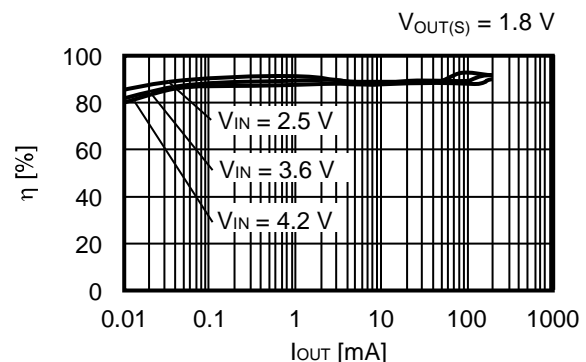
■ Package

- SNT-6A
(1.80 mm \times 1.57 mm \times t0.5 mm max.)

■ Typical Application Circuit



■ Efficiency



S-85S1P Series

SUPPLY VOLTAGE DIVIDED OUTPUT, 5.5 V INPUT, 200 mA SYNCHRONOUS STEP-DOWN SWITCHING REGULATOR WITH 260 nA QUIESCENT CURRENT

The S-85S1P Series introduces own distinctive low power consumption control and COT (Constant On-Time) control and features ultra low current consumption and fast transient response. PWM / PFM switching control automatically switches to PFM control when under light load, and the IC operates at ultra low current consumption of 260 nA quiescent current. The S-85S1P Series realizes high efficiency in a wide range of load current consumption and provides strong support for extended period operation of mobile devices and wearable devices which are equipped with compact batteries.

The function of the supply voltage divided output is prepared in the S-85S1P Series. The supply voltage divided output is a function that divides the input voltage (V_{IN}) of the DC-DC converter into $V_{IN}/2$ or $V_{IN}/3$ and outputs the voltage. For example, this function makes it possible that the IC connects to a low voltage microcontroller A/D converter directly and the microcontroller monitors a battery voltage.

■ Features

DC-DC converter block

- Ultra low current consumption: 260 nA quiescent current
- Efficiency (when under 100 μ A load): 90.5%
- Fast transient response: COT control
- Input voltage: 2.2 V to 5.5 V
- Output voltage: 0.7 V to 2.5 V, in 0.05 V step
2.6 V to 3.9 V, in 0.1 V step
- Output voltage accuracy: $\pm 1.5\%$ ($1.0 \text{ V} \leq V_{OUT} \leq 3.9 \text{ V}$)
 $\pm 15 \text{ mV}$ ($0.7 \text{ V} \leq V_{OUT} < 1.0 \text{ V}$)
- Switching frequency: 1.0 MHz (at PWM operation)
- High side power MOS FET on-resistance: 420 m Ω
- Low side power MOS FET on-resistance: 320 m Ω
- Soft-start function: 1 ms typ.
- Under voltage lockout function (UVLO): 1.8 V typ. (detection voltage)
- Thermal shutdown function: 135°C typ. (detection temperature)
- Overcurrent protection function: 450 mA (at L = 2.2 μ H)
- Automatic recovery type short-circuit protection function: Hiccup control
- Input and output capacitors: Ceramic capacitor compatible

Supply voltage divider block

- Low current consumption: 280 nA typ.
- Input voltage: 1.5 V to 5.5 V
- Output voltage: $V_{IN}/2$ (S-85S1PCxx)
 $V_{IN}/3$ (S-85S1PDxx)

Overall

- Operation temperature range: $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$
- Lead-free (Sn 100%), halogen-free

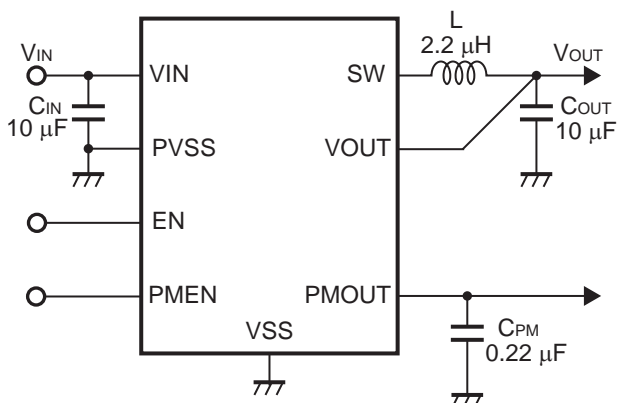
■ Applications

- Wearable device
- Bluetooth device
- Wireless sensor network device
- Healthcare equipment
- Smart meter
- Portable game device

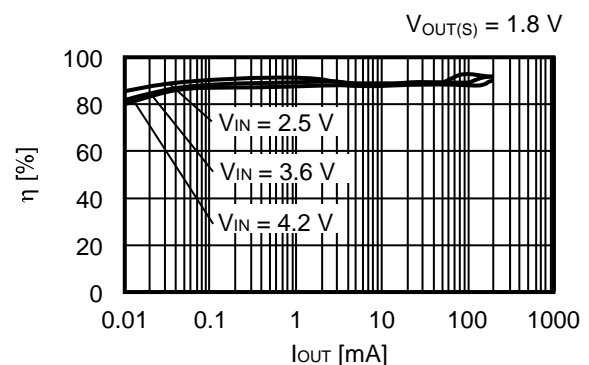
■ Package

- SNT-8A
(2.46 mm \times 1.97 mm \times t0.5 mm max.)

■ Typical Application Circuit



■ Efficiency



S-85V1A Series

5.5 V INPUT, 200 mA SYNCHRONOUS STEP-DOWN SWITCHING REGULATOR WITH 10 μ A QUIESCENT CURRENT

The S-85V1A Series is a step-down switching regulator which features high efficiency and fast transient response. Since PWM / PFM switching control automatically switches to PFM control when under light load, high efficiency is realized. This IC is suitable for mobile devices and battery powered devices due to introduction of own distinctive COT (Constant On-Time) control.

Also, high-density mounting is realized by adopting super-small, thin SNT-6A package. Therefore, the occupancy area including a coil, an input capacitor and an output capacitor can be reduced to $2.0 \text{ mm} \times 4.5 \text{ mm} = 9.0 \text{ mm}^2$, and it contributes to miniaturization of electronic equipment.

■ Features

- Current consumption: 10 μ A quiescent current
- Efficiency: 93%
- Fast transient response: COT control
- Input voltage: 2.2 V to 5.5 V
- Output voltage: 0.7 V to 2.5 V, in 0.05 V step
2.6 V to 3.9 V, in 0.1 V step
- Output voltage accuracy: $\pm 1.5\%$ ($1.0 \text{ V} \leq V_{\text{OUT}} \leq 3.9 \text{ V}$)
 $\pm 15 \text{ mV}$ ($0.7 \text{ V} \leq V_{\text{OUT}} < 1.0 \text{ V}$)
- Switching frequency: 1.0 MHz (at PWM operation)
- High side power MOS FET on-resistance: 450 m Ω
- Low side power MOS FET on-resistance: 350 m Ω
- Soft-start function: 1 ms typ.
- Under voltage lockout function (UVLO): 1.8 V typ. (detection voltage)
- Thermal shutdown function: 135°C typ. (detection temperature)
- Overcurrent protection function: 450 mA (at L = 2.2 μ H)
- Automatic recovery type short-circuit protection function: Hiccup control
- Input and output capacitors: Ceramic capacitor compatible
- Operation temperature range: $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$
- Lead-free (Sn 100%), halogen-free

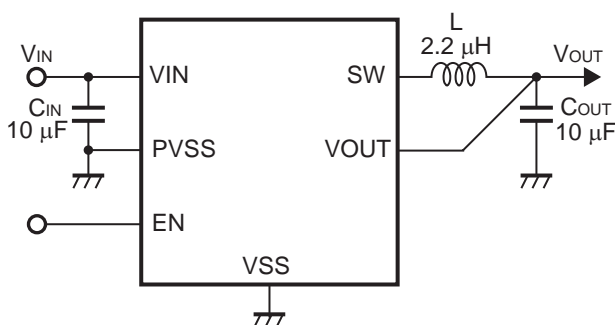
■ Applications

- Bluetooth device
- Wireless sensor network device
- Healthcare equipment
- Smart meter
- Portable game device
- Remote control

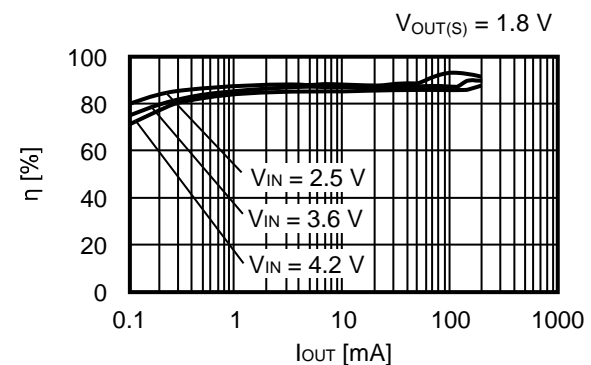
■ Package

- SNT-6A
(1.80 mm \times 1.57 mm \times t0.5 mm max.)

■ Typical Application Circuit



■ Efficiency



S-8821 Series

VOLTAGE REGULATION BOOST CHARGE PUMP DC-DC CONVERTER

The S-8821 series is a CMOS boost charge pump DC-DC converter with a voltage regulation function. The S-8821 series consists of an oscillation circuit, a controller, a reference voltage circuit, an error amplifier circuit, and an output switching transistor, and can regulate the output voltage by PFM control. Since small ceramic capacitors can be used for the pump capacitor, input capacitor, and output capacitor, the mounting area can be minimized.

■ Features

- PFM control CMOS boost charge pump
- Power supply voltage: 1.6 to 5.0 V
- Output voltage: 2.5 to 5.5 V, selectable in 0.1 V steps.
- Output voltage accuracy: $\pm 2\%$ max.
- Built-in soft start circuit: 1.0 ms typ.
- Output current: 25 mA ($V_{IN} = (V_{OUT(S)} \times 0.80)$ V)
- Oscillation frequency: 1.0 MHz typ.
- ON/OFF function: During standby: 1 μ A max.
- Lead-free, Sn 100%, halogen-free*1

*1. Refer to “**■ Product Name Structure**” for details.

■ Applications

- Lithium ion battery driven applications
- Local power supply
- Power supply for white LED display backlights

■ Packages

- SOT-23-6W
- SNT-8A

S-77100/77101 Series

POWER SEQUENCER

The S-77100/77101 Series is a power sequencer.

The S-77100 Series can output enable signals of 4 channels, and controls the external power supply circuit. The S-77100 Series turns on and off the enable signals successively by changing "H" and "L" of the ON pin.

The S-77101 Series can output enable signals of 3 channels, and controls the external power supply circuit. The S-77101 Series turns on the enable signals successively by changing the ON pin from "L" to "H", and turns off the enable signals successively by changing $\overline{\text{OFF}}$ pin from "H" to "L".

The delay time for each enable signal can be set by the external capacitor.

Also, the small 8-Pin TSSOP or SNT-8A package makes high-density mounting possible.

■ Features

- Easy support for sequencing of multiple power supplies.
- Delay time can be set by the external capacitor.
- Sequence operations of 4 channels can be controlled by 1 input signal. (S-77100 Series)
- On-sequence operation and off-sequence operation can be controlled by the separate input signal. (S-77101 Series)
- Enable output can be increased by cascade connection.
- Low current consumption: 3.0 μA typ. (Off period, power-good period, $V_{\text{DD}} = 3.3 \text{ V}$, $T_{\text{a}} = +25^{\circ}\text{C}$)
- Wide range of operation voltage: 2.2 V to 5.5 V
- Operation temperature range: $T_{\text{a}} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$
- Output form is selectable: CMOS output, Nch open-drain output
- Output logic is selectable: Active "H", active "L"
- Lead-free (Sn 100%), halogen-free:

■ Applications

- Power sequencing for multiple devices
- Sequencing for microprocessor and microcontroller
- Power sequencing for FPGA
- Power sequencing for TV, camera, printer, etc.

■ Packages

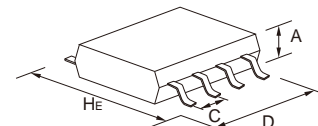
- 8-Pin TSSOP
- SNT-8A

Package List

| Package Type | Pin Count | Package Name | Package Size (mm) | | | Pitch (mm) | |
|---------------------|---------------|---------------------------|-------------------|------|----------|------------|------|
| | | | H _E | D | A (max.) | C | |
| Lead insertion type | 3 | TO-92 | 14.5 | 5.2 | 4.2 | 2.5/1.27 | |
| Flat-lead type | 3 | SOT-89-3 | 4.0 | 4.5 | 1.6 | 1.5 | |
| | 5 | SOT-89-5 | 4.5 | 4.5 | 1.6 | 1.5 | |
| Gull-wing type | 4 | SC-82AB | 2.1 | 2.0 | 1.1 | 1.3 | |
| | 5 | SC-88A | 2.1 | 2.0 | 1.1 | 0.65 | |
| | 3 | SOT-23-3 | 2.8 | 2.9 | 1.3 | 1.9 | |
| | 3 | SOT-23-3S | 2.8 | 2.9 | 1.2 | 1.9 | |
| | 3 | TSOT-23-3S | 2.85 | 2.9 | 0.8 | 1.9 | |
| | 5 | SOT-23-5 | 2.8 | 2.9 | 1.3 | 0.95 | |
| | 6 | SOT-23-6 | 2.8 | 2.9 | 1.35 | 0.95 | |
| | 6 | SOT-23-6W | 2.8 | 2.9 | 1.3 | 0.95 | |
| | 8 | 8-Pin SOP (JEDEC) | 6.0 | 5.02 | 1.75 | 1.27 | |
| | 8 | 8-Pin TSSOP | 6.4 | 3.0 | 1.1 | 0.65 | |
| | 16 | 16-Pin TSSOP | 6.4 | 5.1 | 1.1 | 0.65 | |
| | 20 | 20-Pin TSSOP | 6.4 | 6.5 | 1.2 | 0.65 | |
| | 24 | 24-Pin SSOP | 7.6 | 7.9 | 1.4 | 0.65 | |
| | 8 | TMSOP-8 | 4.0 | 2.9 | 0.8 | 0.65 | |
| | 8 | HTMSOP-8 | 4.0 | 2.9 | 0.8 | 0.65 | |
| | 16 | HTSSOP-16 | 6.4 | 5.12 | 1.1 | 0.65 | |
| | 6 | HSOP-6 | 6.0 | 5.02 | 1.75 | 1.91 | |
| | 8 | HSOP-8A | 6.0 | 5.02 | 1.68 | 1.27 | |
| | 8 | HSOP-8Q | 6.0 | 5.02 | 1.68 | 1.27 | |
| | 5 | TO-252-5S(A) | 6.5 | 6.5 | 1.4 | 1.27 | |
| | 9 | TO-252-9S | 6.5 | 6.5 | 1.4 | 0.65 | |
| | Non-lead type | 6 | 6-Pin HSON(A) | 3.0 | 2.9 | 0.9 | 0.95 |
| | | 4 | SNT-4A | 1.6 | 1.2 | 0.5 | 0.65 |
| | | 6 | SNT-6A | 1.8 | 1.57 | 0.5 | 0.5 |
| | | 6 | SNT-6A(H) | 1.8 | 1.57 | 0.5 | 0.5 |
| | | 8 | SNT-8A | 2.46 | 1.97 | 0.5 | 0.5 |
| | | 4 | HSNT-4(0808) | 0.8 | 0.8 | 0.4 | 0.4 |
| 4 | | HSNT-4(0808)B | 0.8 | 0.8 | 0.41 | 0.4 | |
| 4 | | HSNT-4(1010) | 1.0 | 1.0 | 0.4 | 0.65 | |
| 4 | | HSNT-4(1010)B | 1.0 | 1.0 | 0.41 | 0.65 | |
| 6 | | HSNT-6A | 2.46 | 1.96 | 0.5 | 0.5 | |
| 6 | | HSNT-6(1212) | 1.2 | 1.2 | 0.4 | 0.4 | |
| 6 | | HSNT-6D (HSNT-6(1618)) | 1.8 | 1.6 | 0.4 | 0.5 | |
| 6 | | HSNT-6(2025) | 2.46 | 1.96 | 0.5 | 0.5 | |
| 8 | | HSNT-8(1616) | 1.6 | 1.6 | 0.4 | 0.4 | |
| 8 | | HSNT-8(1616)B | 1.6 | 1.6 | 0.41 | 0.4 | |
| 8 | | HSNT-8(2030) | 3.0 | 2.0 | 0.5 | 0.5 | |
| 6 | | DFN-6(1414)A | 1.4 | 1.4 | 0.6 | 0.5 | |
| 6 | | DFN-6(1518)A | 1.8 | 1.5 | 0.33 | 0.5 | |
| 8 | | DFN-8(1616)A | 1.6 | 1.6 | 0.6 | 0.4 | |
| 8 | | DFN-8(2020)A | 2.0 | 2.0 | 0.6 | 0.5 | |
| 8 | | DFN-8(2030) | 3.0 | 2.0 | 0.5 | 0.5 | |
| 8 | | DFN-8(2030)A | 3.0 | 2.0 | 0.6 | 0.5 | |
| 8 | | DFN-8(2030)B | 3.0 | 2.0 | 0.8 | 0.5 | |

Remarks 1. For more details, please refer to our website. [Package List on ablic.com](http://ablic.com)

2. Please contact our sales representatives regarding WLP package products.



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