● Description

The S-8435/8436 are CMOS step-up switching regulators that consist of a reference voltage source, a CR oscillator, a power MOS FET, a diode, and a comparator. The output voltage is fixed internally, and a shutdown function is available. The current consumption is drastically minimized because of the CMOS configuration. They feature low voltage operation. The S-8435 Series easily forms a step-up switching regulator using only an external coil and capacitor, because of a built-in transistor. The S-8436 Series employs an external power transistor with a low on-resistance to boost the available output current. This device is ideal for the user who needs current output from less than 100 mA up to several hundred millamps. These series are suitable for use as power sources for portable devices because of their small 5-pin package and few external parts.

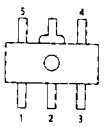
● Features

- Only 2 external components required: Coil and capacitor
- Built-in Schottky diode (S-8435 Series)
- Built-in CR oscillation circuit
- Ultra low current consumption: 5.0 μA typ; Shutdown = 0.2 μA max
- Highly accurate output voltage: ± 3%
- Low voltage operation: 0.9V @ 1mA
- Output current > 100 mA with S-8436
- 90% Efficiency
- Wide output voltage range: 1.5 to 12V
- Compact SOT-89-5 Package

● Applications

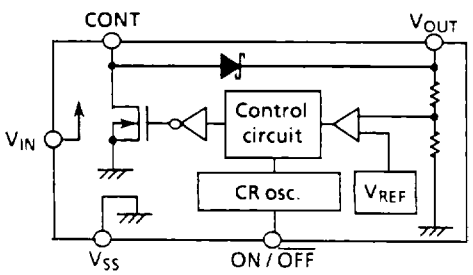
- Constant voltage source for devices requiring higher voltages than battery provides
- Battery life extension
- Power supplies for portable instruments:
  - Pagers
  - Calculators
  - Cordless/Portable Phones
- Constant voltage power supplies for:
  - Cameras
  - Video equipment
  - Portable inventory control equipment

● Pin Diagram

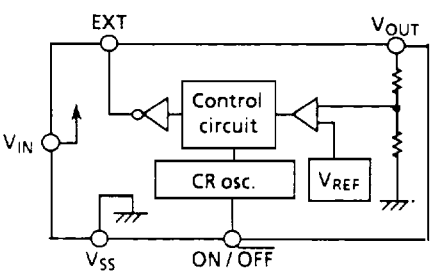


● Block Diagrams

(1) S-8435 Series



(2) S-8436 Series



● Pin Assignments

Pin No.	S-8435	S-8436	Description
1	CONT	EXT	CONT: External inductor connection terminal EXT: External transistor connection terminal
2	V_{SS}		GND terminal
3	ON/OFF		Shutdown terminal "H": Normal operation (step-up) "L": Step-up stop (oscillation circuit stop)
4	V_{IN}		Positive power terminal
5	V_{OUT}		Output voltage terminal

● Product Selection

Output voltage	S-8435XF Series	S-8436XF Series	Standard
1.5V ± 3%	S-8435AF-SK-X	S-8436XF Series	
3.0V ± 3%	S-8435BF-SB-X	S-8436BF-XB-X	S
5.0V ± 3%	S-8435CF-SD-X	S-8436CF-XD-X	S
3.6V ± 3%	S-8435DF-S7-X	S-8436DF-X7-X	
3.7V ± 3%	S-8435EF-SE-X	--	
12.0V ± 3%	S-8435FF-WK-X	S-8436FF-YK-X	S

● Electrical Characteristics

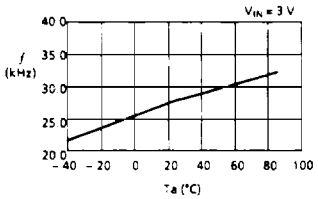
Unless otherwise specified: Ta = 25°C

Parameter	Symbol	Conditions	Ratings
Supply voltage	V_{IN}		10 V nom, 13 V max
Input voltage	CONT, ON/OFF, EXT, V_{OUT}		V_{SS} - 0.3V to 13 V
Start voltage	V_{ST}	I_{OUT} = 100 µA	0.9V max
Power dissipation	P_D		500 mV max
Oscillating frequency	f_{OSC}	V_{OUT} < 12 V V_{OUT} = 12 V	20 kHz min, 30 kHz typ, 50 kHz max 12 kHz min, 24kHz typ, 45kHz max
Current consumption	I_{SS}	ON/OFF = high	5 µA typ, 15 µA max for 12V, 10 µA typ, 12.2 µA max
Shutdown current	I_{SSS}	ON/OFF = low	0.2 µA max
Output current	I_{OUT}		20 - 40 mA typ > 100 mA with S-8436
Switching current	I_{SW}	for S-8435 only	250 mA typ
Line regulation	ΔV_{OUT}		30 mV typ, 100mV max for 12V, 90 mV typ, 150 mV max
Load regulation	ΔV_{OUT}		30 mV typ, 100 mV max for 12V, 100 mV typ, 180 mV max
Shutdown terminal Input Voltage	V_{SH}	high	0.9V - 1.5V min
	V_{SL}	low	0.4V max
Switching transistor leakage current	I_{SWG}	V_{DS} = 10 V (for S-8435 only)	1.0 mA max
Output voltage at shutdown	$V_{OUT\,off}$	ON/OFF = low I_{OUT} = 100 µA using built in Schottky diode	0.6V, 0.9V, 1.4V, 2.4V, or 4.4V depending on V_{IN}
Operating temperature	T_{opr}		- 40°C to + 85°C
Storage temperature	T_{stg}		- 40°C to + 125°C
Output voltage temperature coefficient per volt	$\frac{\Delta V_{OUT}}{\Delta Ta}$		± 0.076 % mV/°C per volt

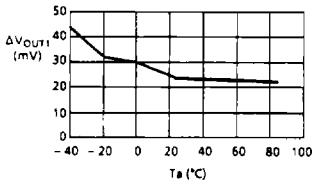
Coil: RCH654 for S-8436 (100 µH) of Sumida Electric Co., Ltd., (RCH855) for 12V S-8435
Diode: D1NS4 of Shindengen Co., ltd.
Capacitor: CACFM1A22OM (22µF) of Marcon Electric Co., Ltd.
Transistor: 2SC3279 of Toshiba Corp.

● Typical Operating Characteristics

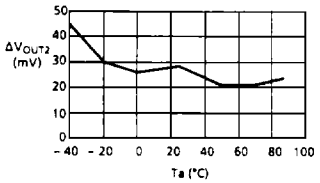
f vs Ta



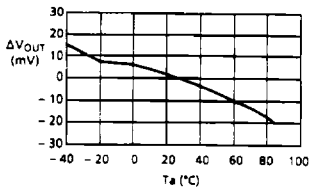
$\Delta V_{OUT}1$ vs Ta



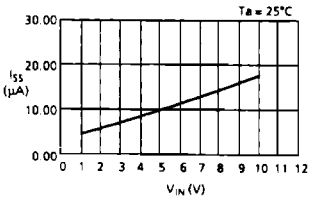
$\Delta V_{OUT}2$ vs Ta



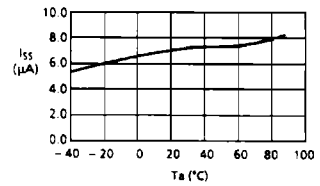
ΔV_{OUT} vs Ta



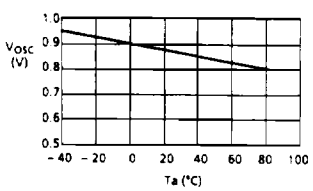
I_{SS} vs V_{IN}



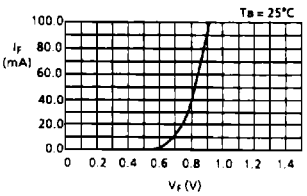
I_{SS} vs Ta



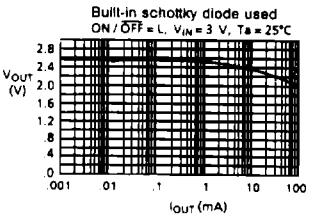
V_{OSC} (Oscillation start voltage) vs Ta



Vf (forward voltage) vs If (forward current) built-in Schottky Diode



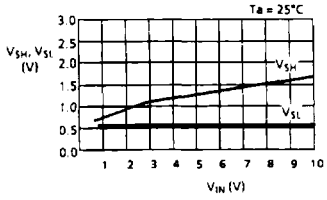
V_{OUT} vs I_{OUT}



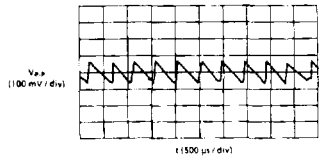
* Where ΔV_{OUT} difference between V_{OUT} and V_{OUT} at 25°C

• Typical Operating Charcteristics, *cont.*

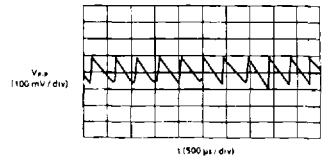
Supply Voltage vs V_{IN} at power off terminal



Ripple Voltage C_{OUT} dependence[1]
C_{OUT} = 69µF, L = 47µH

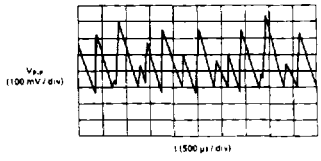


Ripple Voltage C_{OUT} dependence[1]
C_{OUT} = 47µF, L = 47µH

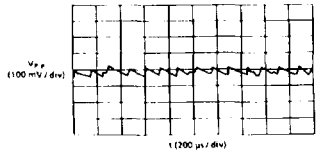


[1]Ripple voltage decreased by increasing C_{OUT} value

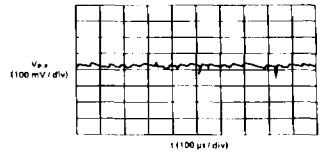
Ripple Voltage C_{OUT} dependence[1]
C_{OUT} = 22µF, L = 47µH



Ripple Voltage Coil dependence[2]
L = 47µH, C_{OUT} = 47µF

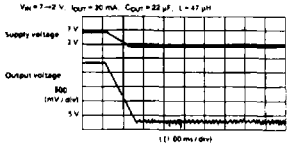


Ripple Voltage Coil dependence[2]
L = 100µH, C_{OUT} = 47µF

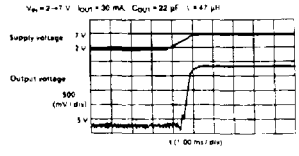


[2]Where ΔV_{OUT} difference between output voltage and output voltage at 100°C

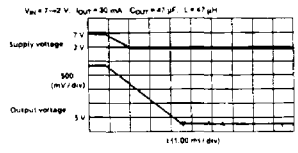
Line transient[3]



Line transient[3]



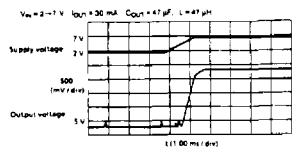
Line transient[3]



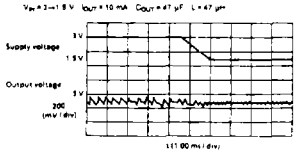
[3] S-8435CF with NLC453232 TDK coil and DINS4 Shindengen diode

- **Typical Operating Charcteristics, *cont.***

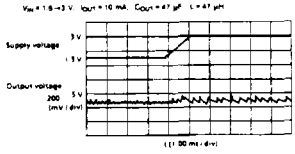
Line transient[3]



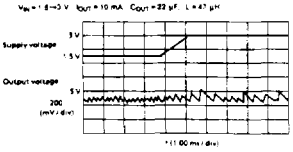
Line transient[3]



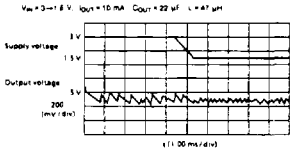
Line transient[3]



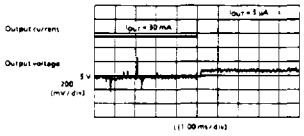
Line transient[3]



Line transient[3]

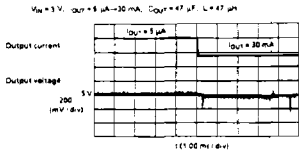


Load transient

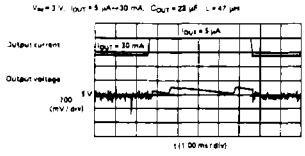


[3] S-8435CF with NLC453232 TDK coil and DINS4 Shindengen diode

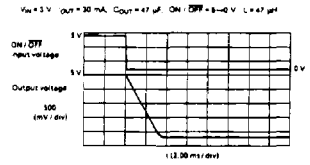
Load transient



Load transient

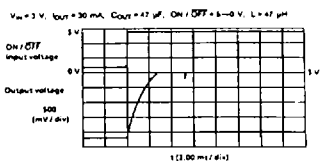


Shutdown terminal response characteristics

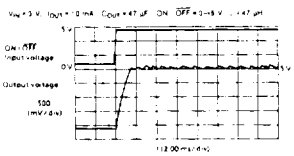


● Typical Operating Charcteristics, *cont.*

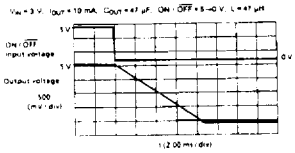
Shutdown terminal response characteristic



Shutdown terminal response characteristic



Shutdown terminal response characteristic



P/N	V_{OUT}	Inductor	L (μH) typ	Mfr.	Diode
S-8435AF/36AF	1.5V	RCH855	820/100	Sumida	D1S54
S-8435BF/36BF	3V	RCH855	47/100	Sumida	D1S54
S-8435DF/36DF	3.6V	RCH855	47 both	Sumida	D1S54
S-8435EF	3.7V	RCH855	47	Sumida	D1S54
S-8435CF/36CF	5V	RCH855	47	Sumida	D1S54
S-8435FF/36FF	12V	RCH855	100	Sumida	D1S54

Inductors

Sumida Electric Co. (USA), LTD.
(708) 956-0666/7

TDK
(708) 803-6100

Toko America, Inc.
(708) 297-0070

Capacitors (Ta = tantalum, Al = aluminum, C = ceramic)

AVX (Ta)
(803) 448-9411

Sprague (Ta)
(508) 339-8900

Murata-Erie (C)
(404) 436-1300

Schottky Diodes

Motorola Semiconductor
(602) 244-6900

Shindengen America, Inc.
(708) 593-8585

Philips Discrete Semi. Grp.
(401) 232-0500

* This is only a list of manufacturers known to offer parts for similar applications. It does not constitute an endorsement or recommendation of any components.