

# Switching regulator for DC / DC Converters

## BA9700A / BA9700AF / BA9700AFV

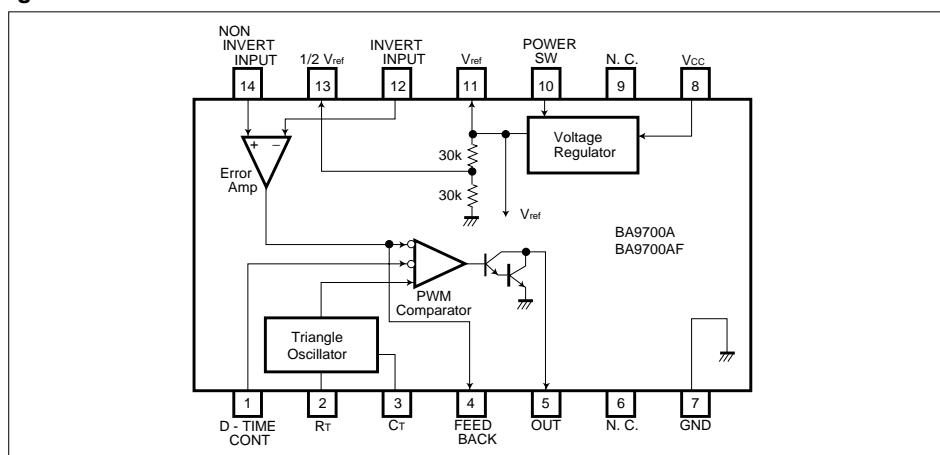
The BA9700A, BA9700AF and BA9700AFV are switching regulators that use a pulse width modulation (PWM) system. They use a transistor switch to stabilize the output voltage.

By the use of the transistor, power loss is decreased, fluctuation efficiency is improved, and the circuit is made more compact and single.

### ●Features

- 1) Output voltage can step up, step down, or invert at an arbitrary level.
- 2) Low current consumption. (typically 1.7mA)
- 3) Wide oscillation frequency range. (typically 2.8k ~ 470kHz)
- 4) Built-in reference voltage current. (typically 2.57V)
- 5) Operates at low voltage. (minimally 3.55V)
- 6) Dead time controller restricts operation when overloaded.
- 7) Power switch can isolate all circuits in the IC.
- 8) Best suited for battery operated equipment.
- 9) Compact 14-pin SSOP package (BA9700AFV).

### ●Block diagram



### ●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	Vcc	24	V
Power dissipation	BA9700A	600 <sup>*1</sup>	mW
	BA9700AF	350 <sup>*2</sup>	
	BA9700AFV	350 <sup>*3</sup>	
Operating temperature	Topr	-20~+80	°C
Storage temperature	Tstg	-55~+150	°C

\*1 BA9700A: Reduced by 4.8 mW for each increase in Ta of 1°C over 25°C.

\*2 BA9700AF: Reduced by 4.4 mW for each increase in Ta of 1°C over 25°C.

\*3 BA9700AFV: Reduced by 3.5 mW for each increase in Ta of 1°C over 25°C.

\*2,\*3 When mounted on a 5.0\*5.0\*1.6 mm glass epoxy board.

# BA9700A / BA9700AF / BA9700AFV

## Regulator ICs

● **Electrical characteristics** (unless otherwise noted,  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V}$ ,  $R_t = 10\text{k}\Omega$ , and  $C_t = 330\text{pF}$ )

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
(Reference voltage section)						
Output voltage	$V_{ref}$	2.48	2.57	2.66	V	$I_{ref} = 0.1\text{mA}$
1/2 $V_{ref}$ output voltage	$1/2 V_{ref}$	1.22	1.29	1.36	V	
Line regulation	Line	-	3.00	12.0	mV	$V_{CC} = 3.55\text{V}\sim 24\text{V}$
Load regulation 1	Load1	-	1.00	5.00	mV	$I_{ref} = 0.1\text{mA}\sim 1.0\text{mA}$
Load regulation 2	Load2	-	6.00	10.0	mV	$I_{ref} = 0.1\text{mA}\sim 8.0\text{mA}$
Output voltage when power decreases	$V_{ref}$	2.48	2.57	2.66	V	$I_{ref} = 0.1\text{mA}$ , $V_{CC} = 3.55\text{V}$
Output current when short-circuited	$I_{osc}$	-	10.0	30.0	mA	$V_{ref} = 0\text{V}$
(Triangular wave oscillation section)						
Oscillation frequency	$f_{osc}$	-	230	-	kHz	$R_T = 10\text{k}\Omega$ , $C_T = 330\text{pF}$
Standard deviation of oscillation frequency	$f_{osc}$	-	10	-	%	$R_T$ and $C_T$ are constant
Frequency variation ( $V_{CC}$ )	$fdv$	-	1	-	%	$V_{CC} = 3.55\sim 24\text{V}$
(Error amplifier section)						
Input offset voltage	$V_{IO}$	-6.0	-	6.0	mV	Null Method
Input offset current	$I_{IO}$	-100	-	100	nA	Null Method
Maximum input voltage	$V_{ICR}$	1.60	1.90	-	V	Null Method
Open loop gain	$A_V$	70.0	80.0	-	dB	Null Method
Common-mode rejection ratio	CMRR	70.0	80.0	-	dB	Null Method
Input bias current	$I_{IB}$	-	180	500	nA	Null Method
(PWM comparator section)						
Threshold voltage 1	$V_{I0}$	-	2.04	2.24	V	DUTY 0%
Threshold voltage 2	$V_{T100}$	1.25	1.43	-	V	DUTY 100%
(Output section)						
Output transistor leakage current	Leak	-	-	10.0	$\mu\text{A}$	$V_o = 24\text{V}$
Output saturation voltage	$V_{sat}$	-	1.70	2.10	V	$I_o = 50\text{mA}$
(Total device)						
Quiescent current	$I_{CC}$	-	1.70	2.40	mA	$R_T = \text{OPEN}$ POWER SW = 2.5V
Standby current	$I_{CCS}$	-	0	7.00	$\mu\text{A}$	POWER SW = 0V
Operating voltage	$V_{CC}$	3.55	-	24.0	V	

Regulator ICs

●Timing chart

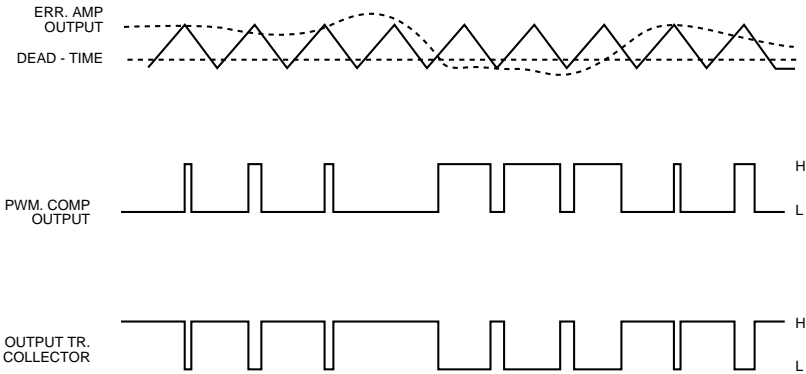


Fig.1

●Application examples

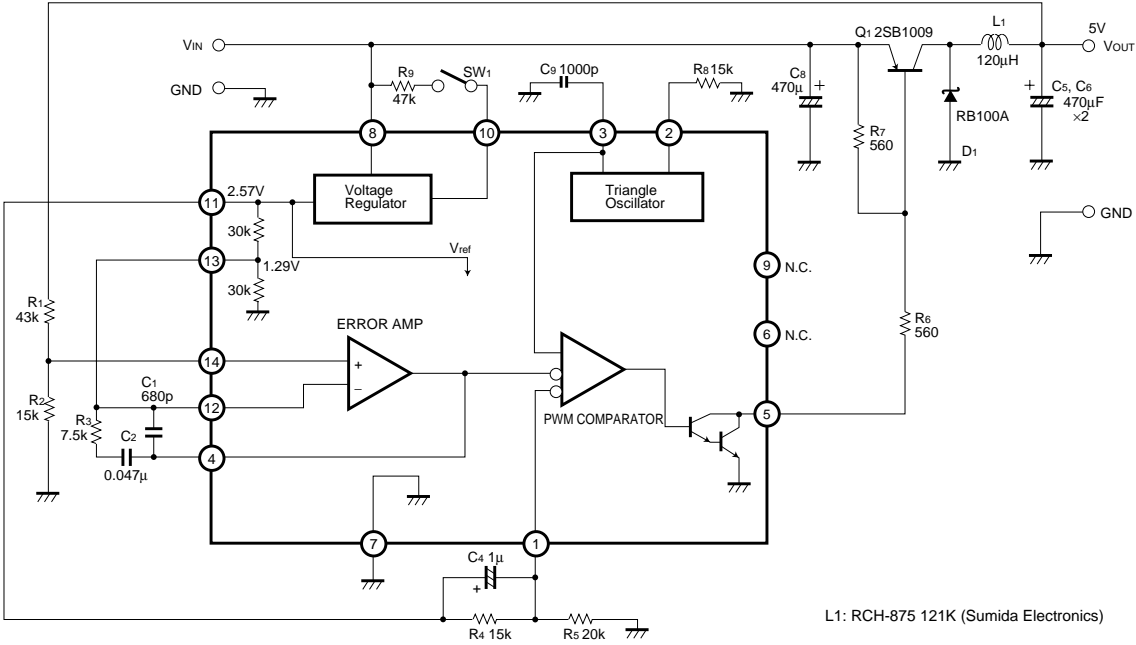


Fig.2 Step-down converter

BA9700A / BA9700AF / BA9700AFV

Regulator ICs

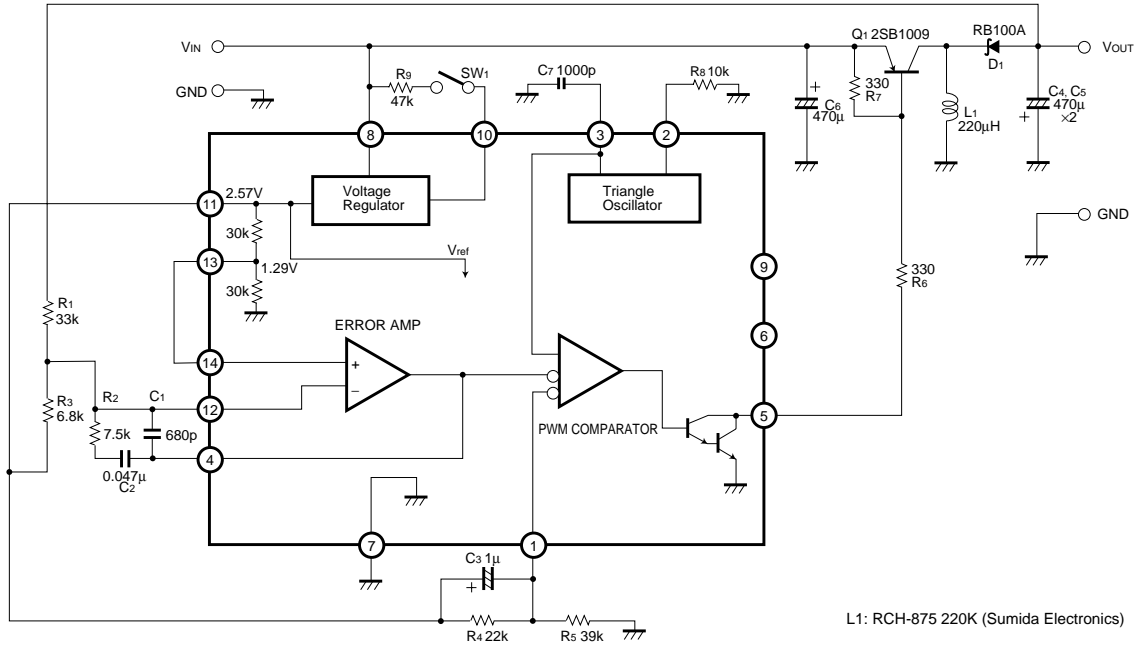


Fig.3 Inverting converter

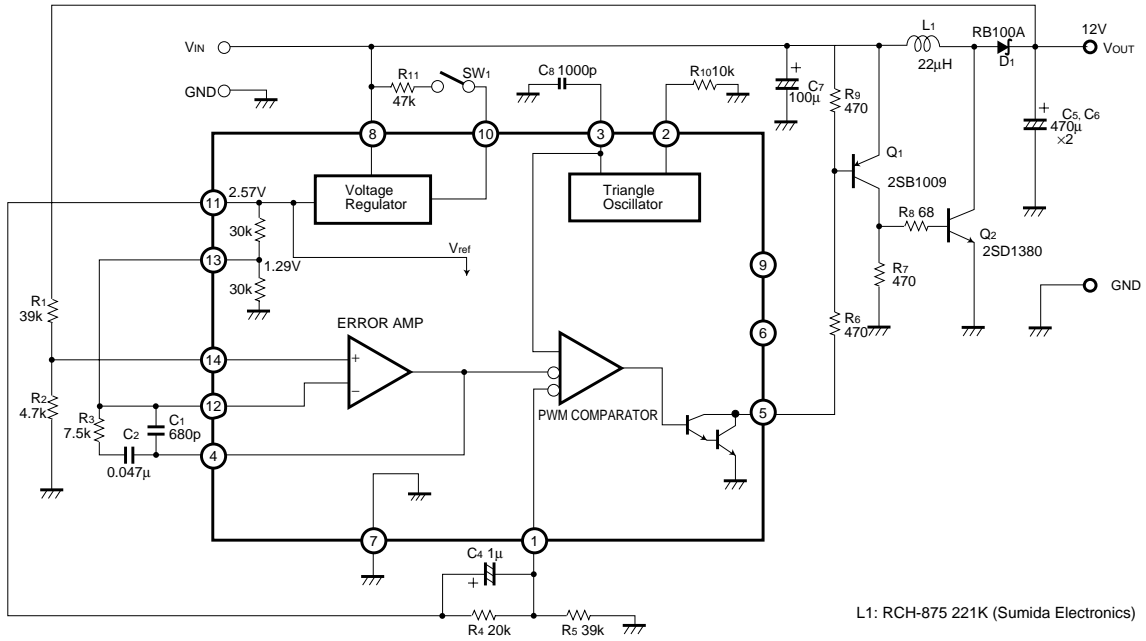


Fig.4 Step-up converter

Regulator ICs

●Basic application board patterns and component arrangements

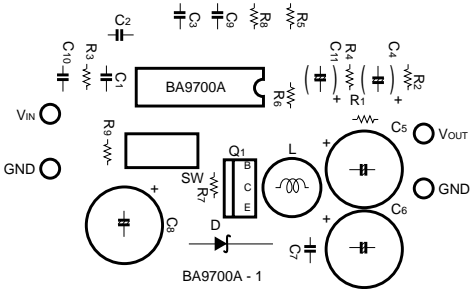
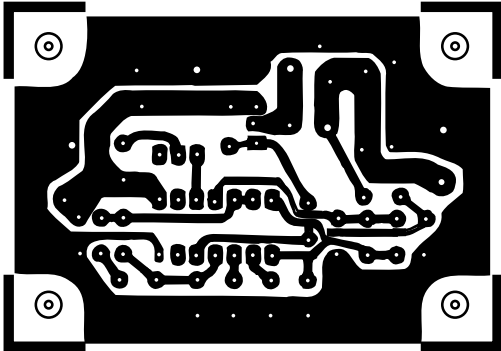


Fig.5 Step-down converter

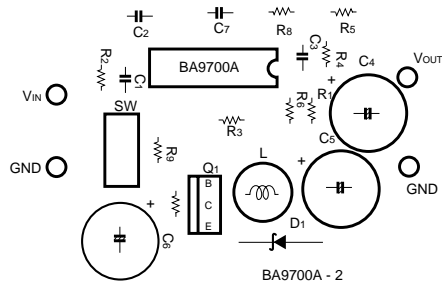
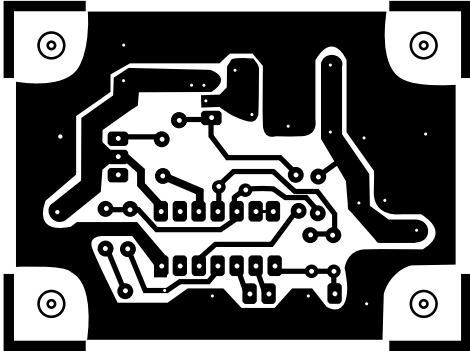


Fig.6 Inverting converter (BA9700A)

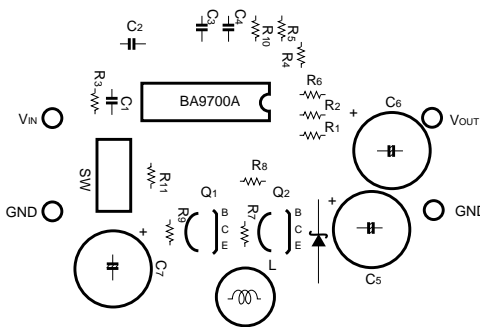
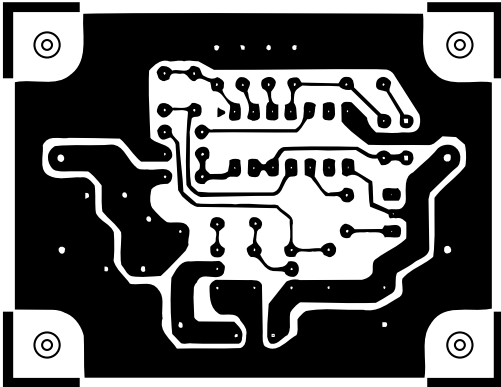


Fig.7 Step-up converter (BA9700A)

Regulator ICs

●Electrical characteristic curves

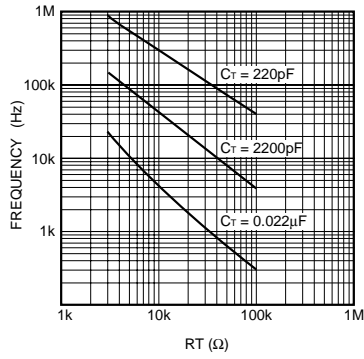


Fig.8 Oscillation frequency characteristic vs. triangular wave oscillator resistance (1)

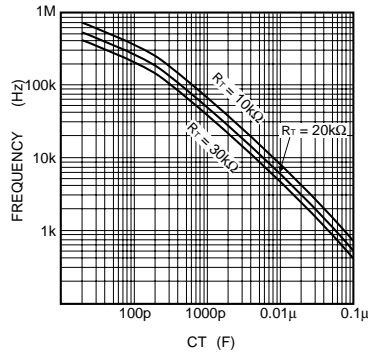


Fig.9 Oscillation frequency characteristic vs. triangular wave oscillator resistance (2)

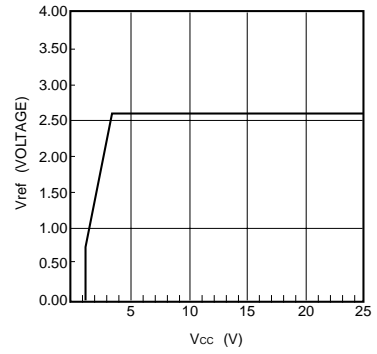


Fig.10 Output voltage vs. operating voltage for the reference voltage section

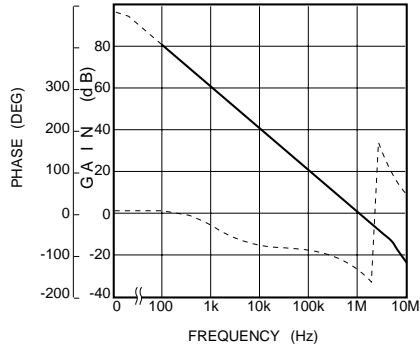
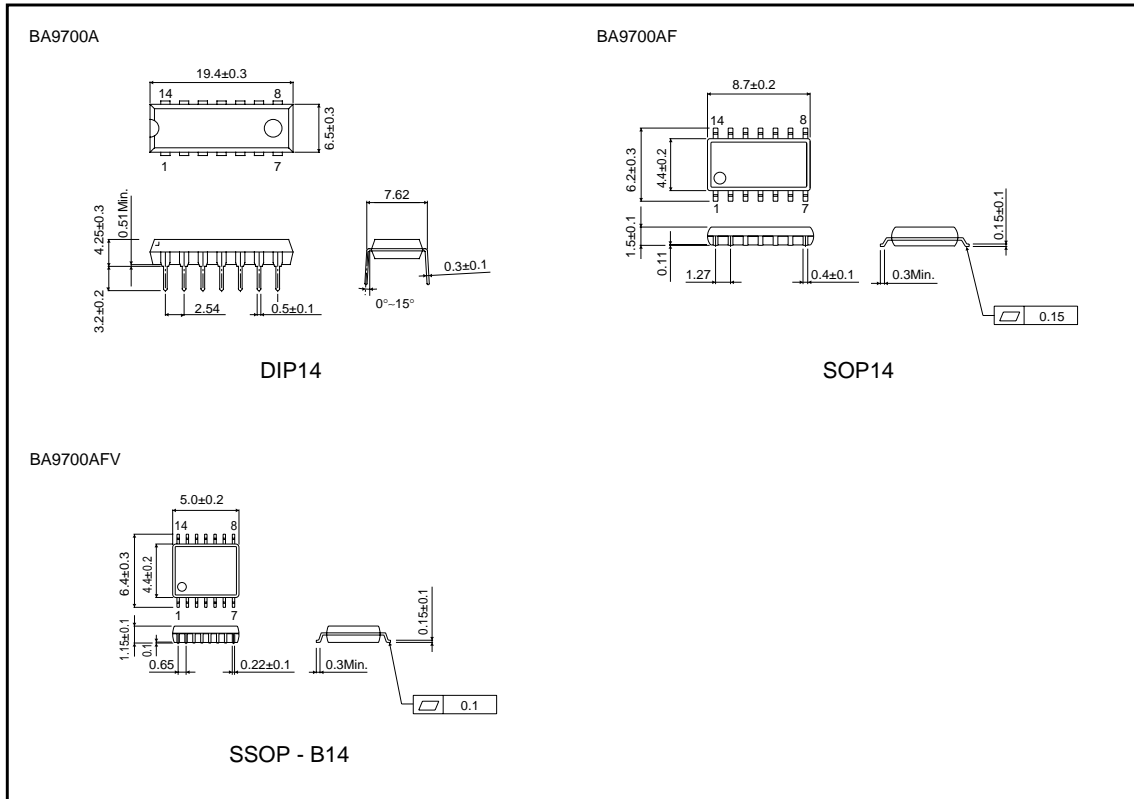


Fig.11 Phase and gain vs. frequency for the error amplifier

# BA9700A / BA9700AF / BA9700AFV

## Regulator ICs

### ● External dimensions (Units : mm)



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