Switching regulator for DC / DC converters

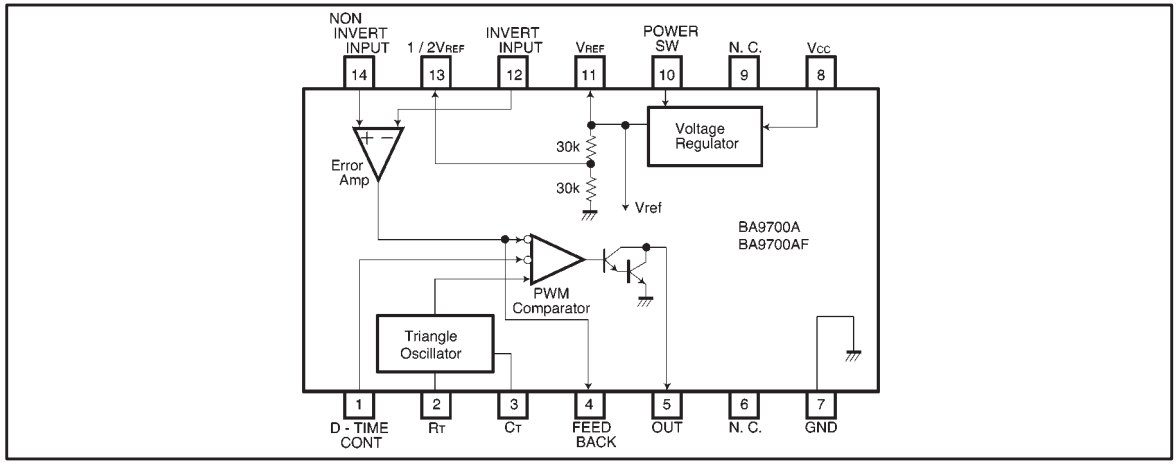
BA9700A / BA9700AF / BA9700AFV

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 over-loaded.
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	Pd	600 *1	mW
	BA9700AF		350 *2	
	BA9700AFV		350 *3	
Operating temperature		Topr	−20～+80	℃
Storage temperature		Tstg	−55～+150	℃

*1 BA9700A: Reduced by 4.8 mW for each increase in Ta of 1℃ over 25℃.
*2 BA9700AF: Reduced by 4.4 mW for each increase in Ta of 1℃ over 25℃.
*3 BA9700AFV：Reduced by 3.5 mW for each increase in Ta of 1℃ over 25℃.
*2,*3 When mounted on a 5.0×5.0×1.6 mm glass epoxy board.

●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 5.0V, R_t = 10kΩ, and C_t = 330pF)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
〈Reference voltage section〉						
Output voltage	V_{ref}	2.48	2.57	2.66	V	I_{ref}=0.1mA
1/2 V_{ref} output voltage	1 / 2V_{ref}	1.22	1.29	1.36	V	
Line regulation	Line	—	3.00	12.0	mV	V_{CC}=3.55V～24V
Load regulation 1	Load1	—	1.00	5.00	mV	I_{ref}=0.1mA～1.0mA
Load regulation 2	Load2	—	6.00	10.0	mV	I_{ref}=0.1mA～8.0mA
Output voltage when power decreases	V_{ref}	2.48	2.57	2.66	V	I_{ref}=0.1mA, V_{CC}=3.55V
Output current when short-circuited	Iosc	—	10.0	30.0	mA	V_{ref}=0V
〈Triangular wave oscillation section〉						
Oscillation frequency	fosc	—	230	—	kHz	R_T=10kΩ, C_T=330pF
Standard deviation of oscillation frequency	fosc	—	10	—	%	R_T and C_T are constant
Frequency variation (V_{CC})	fdv	—	1	—	%	V_{CC}=3.55～24V
〈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_{t0}	—	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	μA	V_O=24V
Output saturation voltage	Vsat	—	1.70	2.10	V	I_O=50mA
〈Total device〉						
Quiescent current	I_{CC}	—	1.70	2.40	mA	R_T=OPEN POWER SW=2.5V
Standby current	I_{CCS}	—	0	7.00	μA	POWER SW=0V
Operating voltage	V_{CC}	3.55	—	24.0	V	

●Timing chart

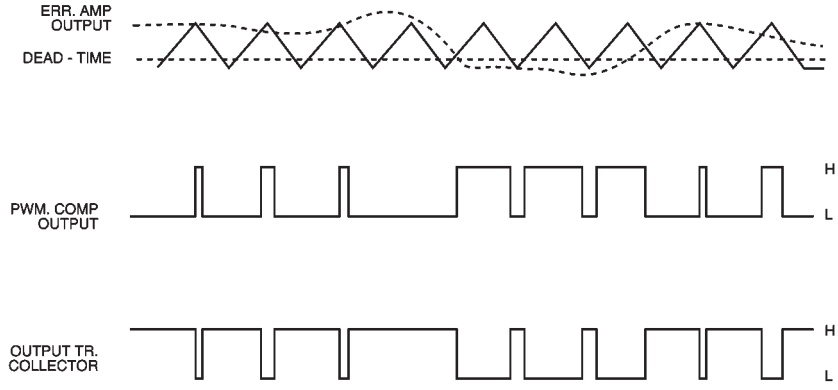


Fig.1

●Application examples

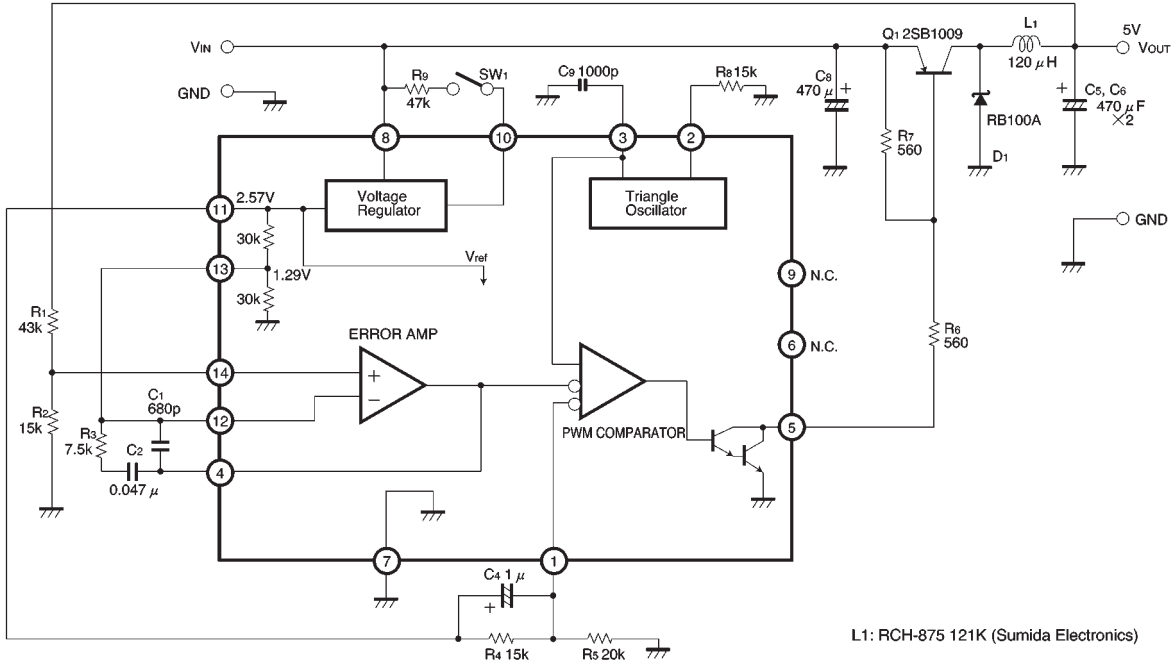


Fig.2 Step-down converter

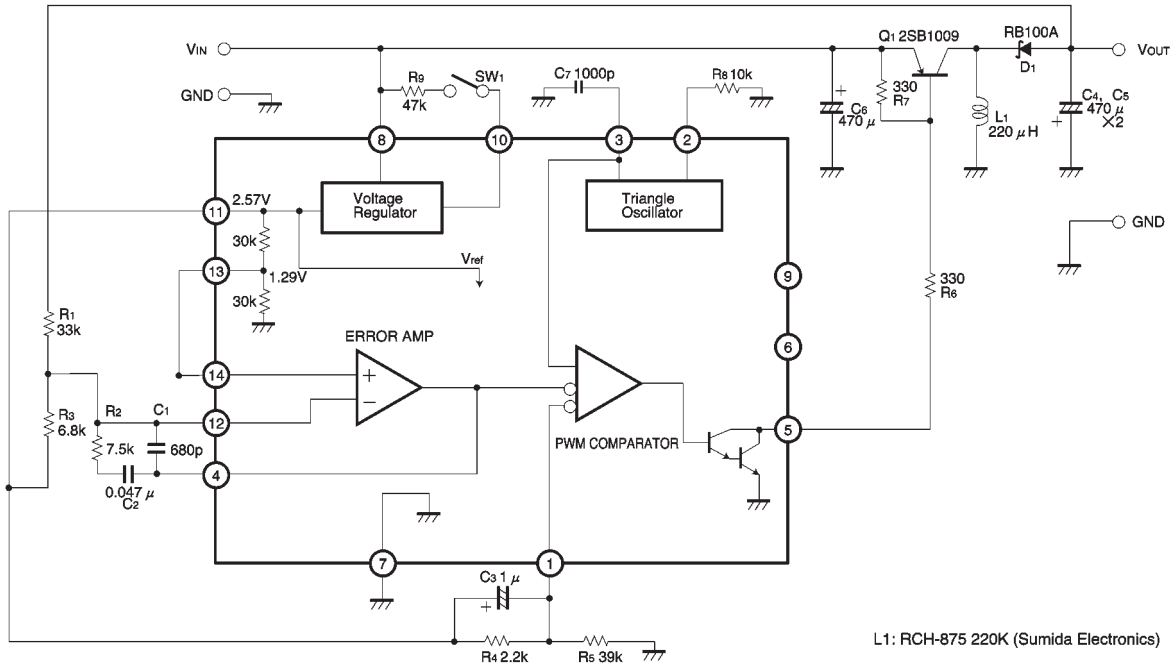


Fig.3 Inverting converter

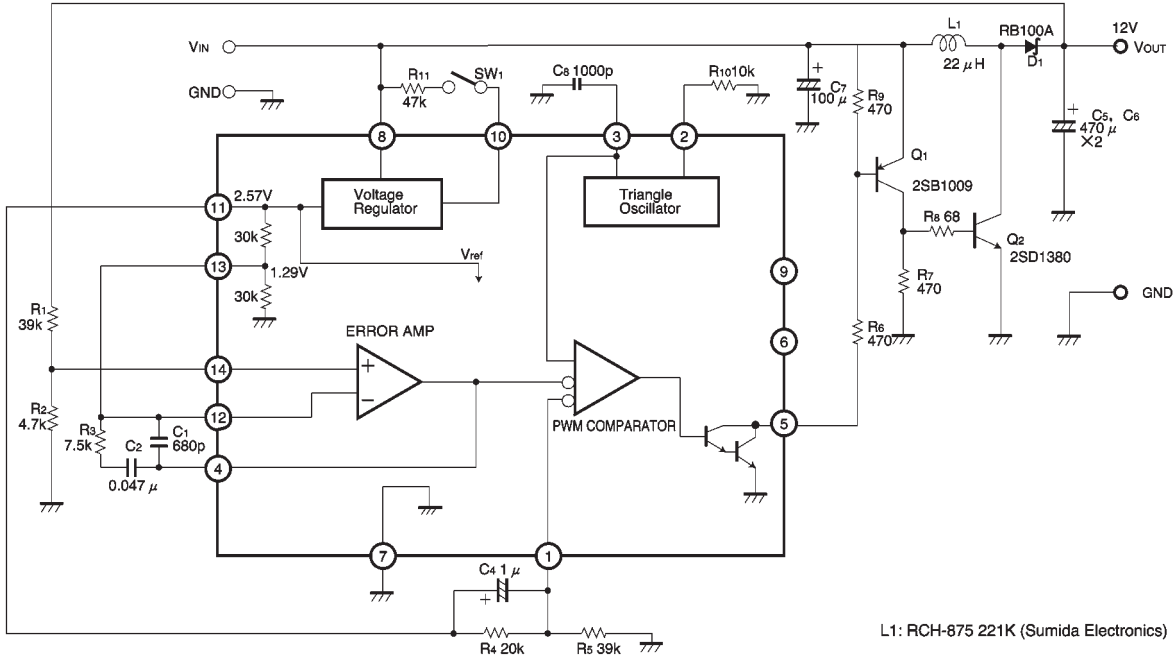
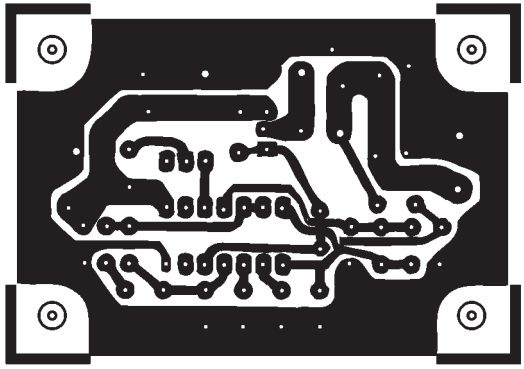


Fig.4 Step-up converter

●Basic application board patterns and component arrangements



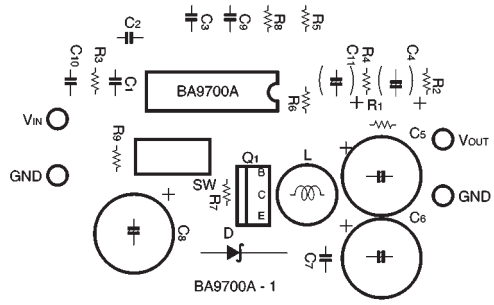
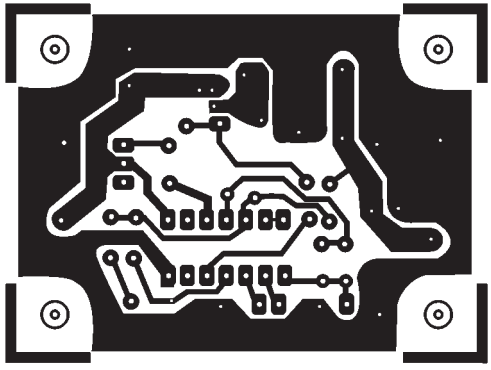


Fig.5 Step-down converter



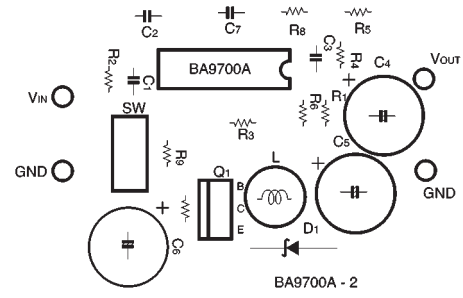
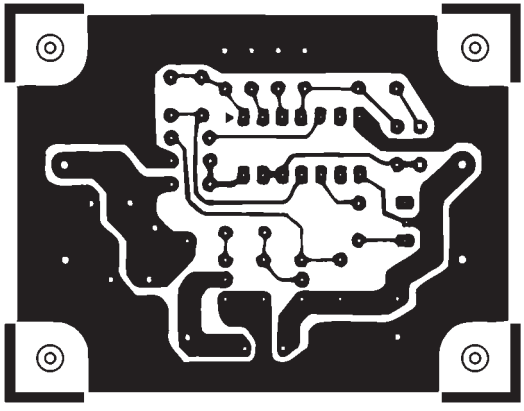


Fig.6 Inverting converter (BA9700A)



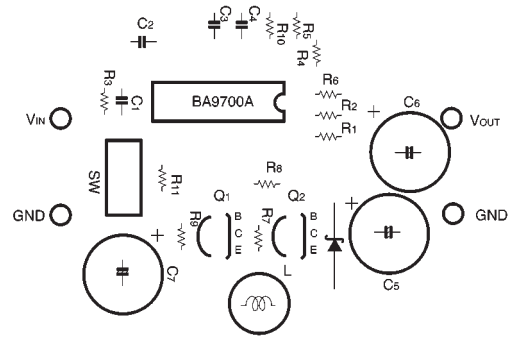


Fig.7 Step-up converter (BA9700A)

●Electrical characteristic curves

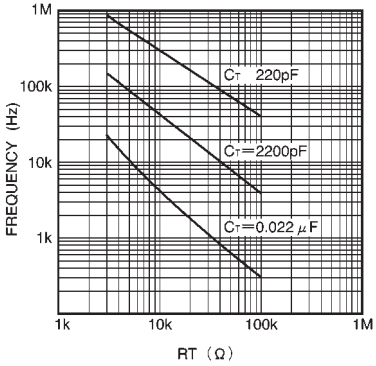


Fig.8 Oscillation frequency characteristic vs. triangular wave oscillator resistance (1)

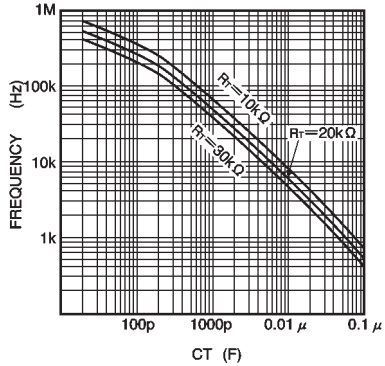


Fig.9 Oscillation frequency characteristic vs. triangular wave oscillator resistance (2)

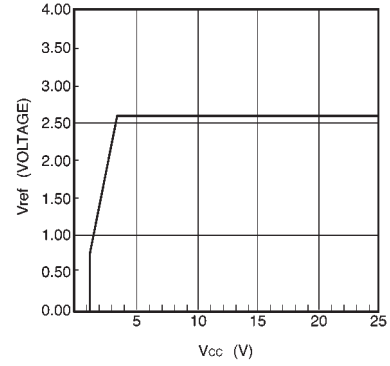


Fig.10 Output voltage vs. operating voltage for the reference voltage section

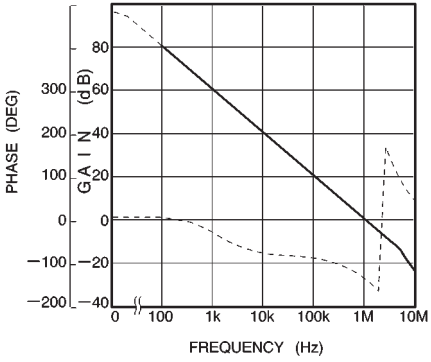
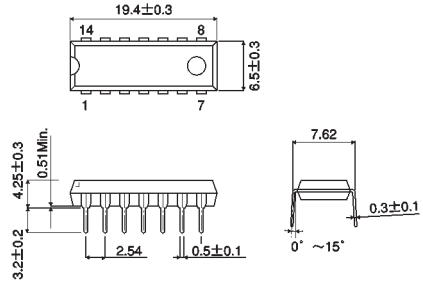


Fig.11 Phase and gain vs. frequency for the error amplifier

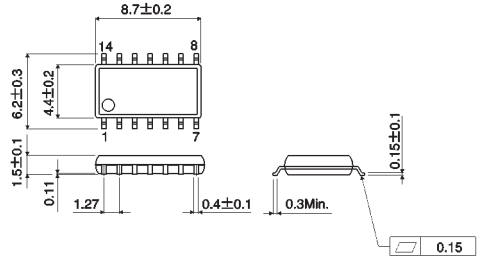
●External dimensions (Units: mm)

BA9700A



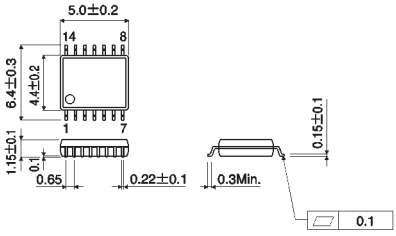
DIP14

BA9700AF



SOP14

BA9700AFV



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