

Switching regulator for DC / DC Converters

BA9700A / BA9700AF / BA9700AFV

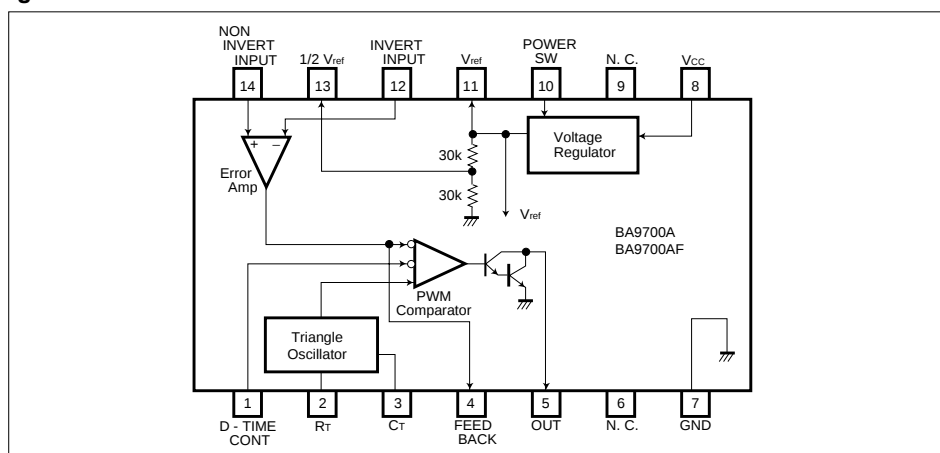
The BA9700A, BA9700AF and BA9700AFV are switching regulators that use a pulse width modulation (PWM) system. They use a transistor switch to stabilize the output voltage.

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 ^{*1}	mW
	BA9700AF	350 ^{*2}	
	BA9700AFV	350 ^{*3}	
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, Ta = 25°C, Vcc = 5.0V, Rt = 10kΩ, and Ct = 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	1/2 V _{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	I _{osc}	-	10.0	30.0	mA	V _{ref} = 0V
(Triangular wave oscillation section)						
Oscillation frequency	f _{osc}	-	230	-	kHz	R _T = 10kΩ, C _T = 330pF
Standard deviation of oscillation frequency	f _{osc}	-	10	-	%	R _T and C _T are constant
Frequency variation (V _{CC})	fdv	-	1	-	%	V _{CC} = 3.55~24V
(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 _{I0}	-	2.04	2.24	V	DUTY 0%
Threshold voltage 2	V _{I100}	1.25	1.43	-	V	DUTY 100%
(Output section)						
Output transistor leakage current	Leak	-	-	10.0	μA	V _O = 24V
Output saturation voltage	V _{sat}	-	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	

ERR. AMP OUTPUT

DEAD - TIME

PWM. COMP OUTPUT

OUTPUT TR. COLLECTOR

The schematic diagram illustrates a 5V step-down converter. The input voltage V_{IN} is connected to the circuit. The output voltage V_{OUT} is 5V, and the load current is 100mA. The circuit includes a voltage regulator, a triangle oscillator, an error amplifier (ERROR AMP), and a PWM comparator. The output filter consists of an inductor $L1$ and a capacitor $C5$. The MOSFET $Q1$ (2SB1009) is used for switching. The diode $D1$ (RB100A) is used for rectification. The circuit is powered by a 5V supply and includes a 100mA load. The schematic is labeled with pin numbers 1 through 14 and includes a legend for $L1$: RCH-875 121K (Sumida Electronics).

ROHM

Regulator ICs

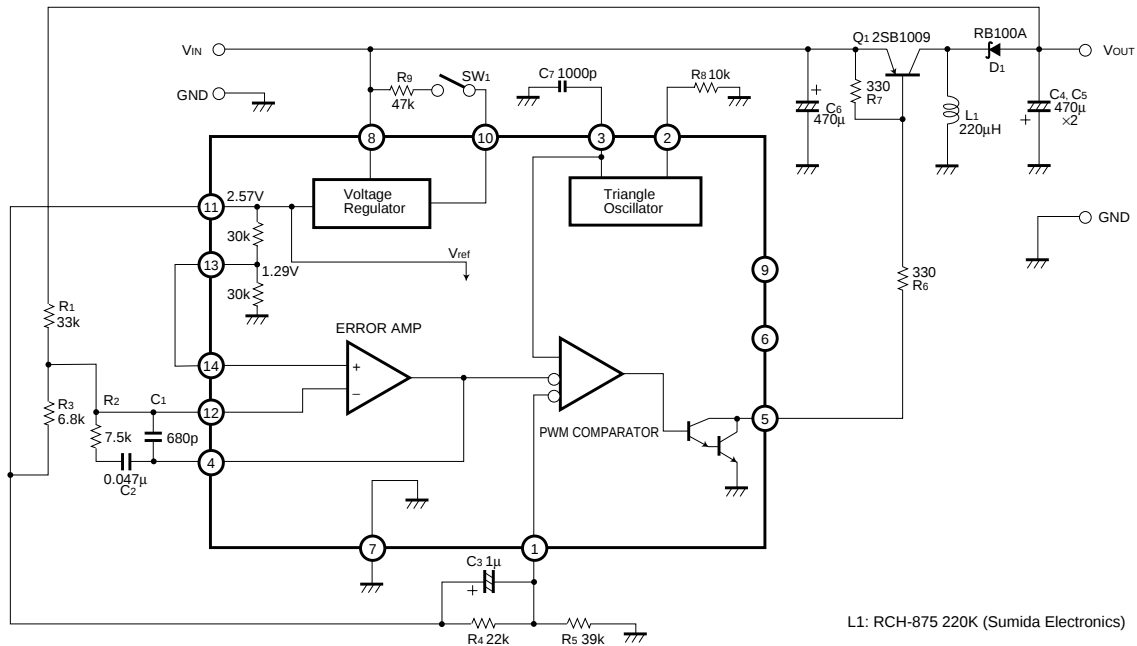


Fig.3 Inverting converter

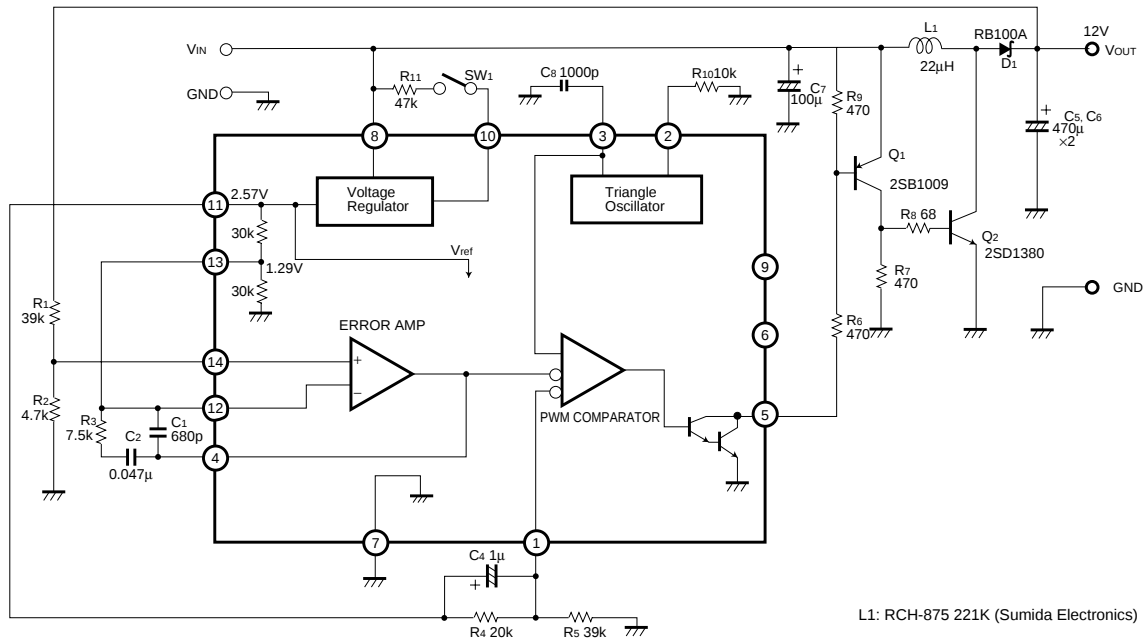


Fig.4 Step-up converter

Regulator ICs

● Basic application board patterns and component arrangements

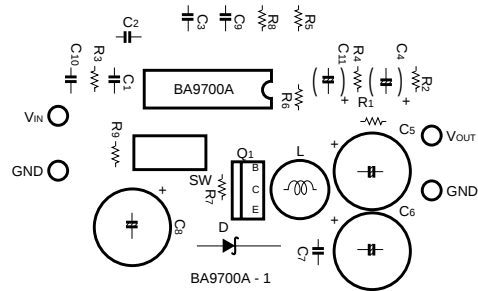
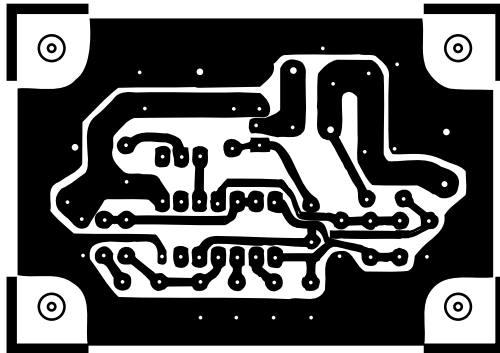


Fig.5 Step-down converter

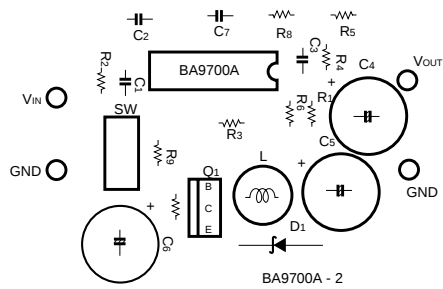
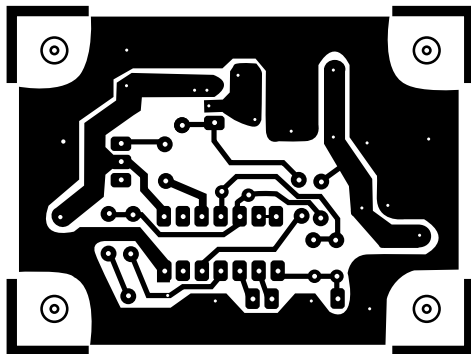


Fig.6 Inverting converter (BA9700A)

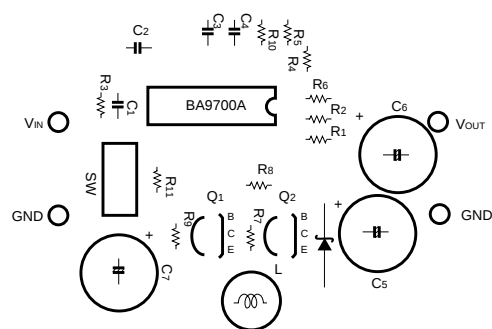
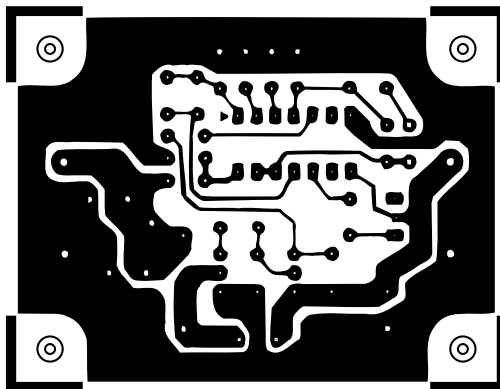


Fig.7 Step-up converter (BA9700A)

Regulator ICs

●Electrical characteristic curves

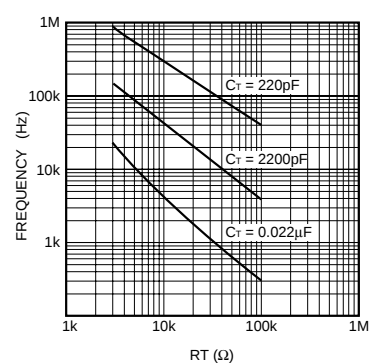


Fig.8 Oscillation frequency characteristic vs. triangular wave oscillator resistance (1)

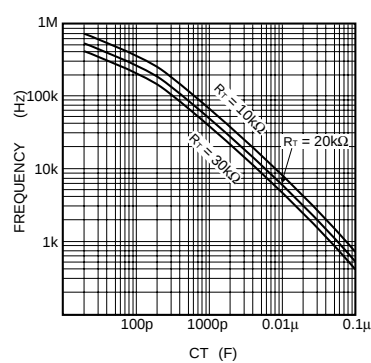


Fig.9 Oscillation frequency characteristic vs. triangular wave oscillator resistance (2)

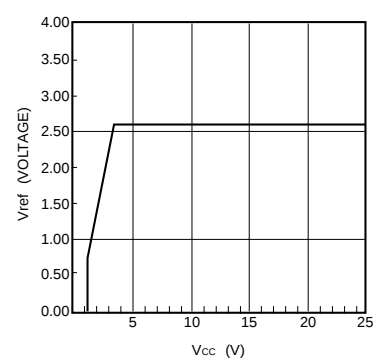


Fig.10 Output voltage vs. operating voltage for the reference voltage section

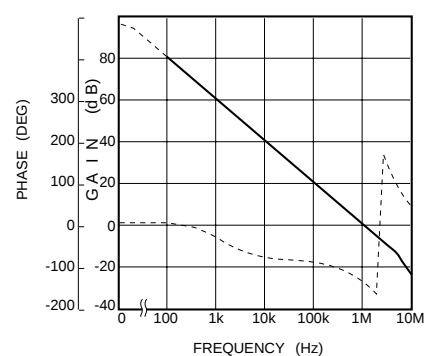


Fig.11 Phase and gain vs. frequency for the error amplifier

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Regulator ICs

●External dimensions (Units : mm)

