

# Two-channel switching regulator controller

## BA9741F / BA9741FS

The BA9741F and BA9741FS are two-channel switching regulator controllers that use the PWM method. Both circuits can be used for DC to DC conversion for step-up, step-down, and inverting. The IC comes in a compact package, making it ideal for use in portable equipment.

### ●Applications

DC/DC converters for video cameras and notebook computers etc.

### ●Features

- 1) High-accuracy reference voltage circuit ( $\pm 1\%$ ).
- 2) Timer-latch, short-circuit protection circuit
- 3) Miss-operation prevention circuit for low-voltage input.
- 4) Reference voltage with output (2.5V).
- 5) Rest period adjustment is possible over the entire duty range.

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

Parameter	Symbol	Limits	Unit
Power supply voltage	V <sub>CC</sub>	36	V
Power dissipation	BA9741F	Pd	500*1
	BA9741FS	Pd	650*1
Operating temperature	Topr	-40~+85	°C
Storage temperature	Tstg	-55~+125	°C
Output current	I <sub>o</sub>	120*2	mA
Output voltage	V <sub>o</sub>	36	V

\*1 When mounted on 70mm×70mm ×1.6mm glass epoxy board.

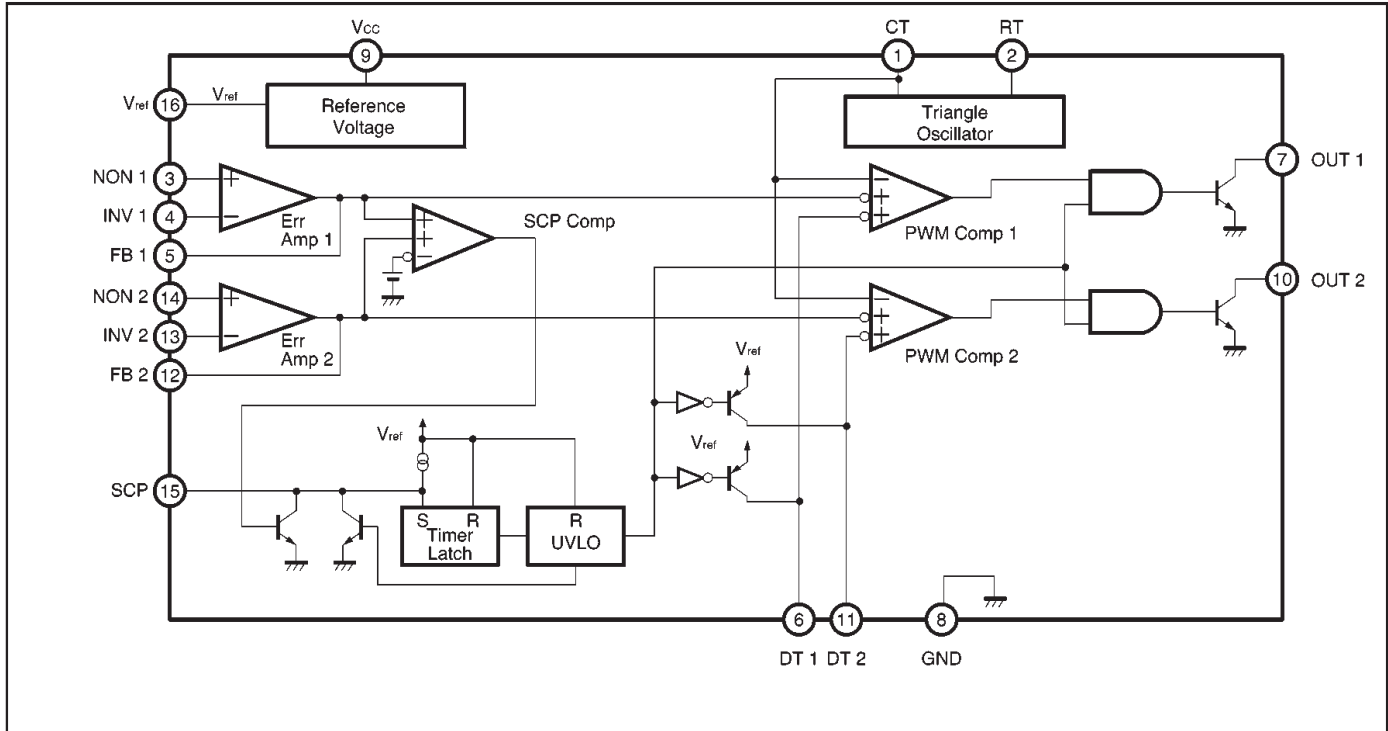
Reduced by 5.0mW(BA9741F),6.5mW(BA9741FS) for each increase in Ta of 1°C over 25°C.

\*2 Should not exceed Pd and ASO values.

### ●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V <sub>CC</sub>	3.6	6.0	35	V
Output current	I <sub>o</sub>	—	—	100	mA
Output voltage	V <sub>o</sub>	—	—	35	V
Error amplifier input voltage	V <sub>OM</sub>	0.3	—	1.6	V
Timing capacitor	C <sub>CT</sub>	100	—	15000	pF
Timing resistor	R <sub>RT</sub>	5.1	—	50	kΩ
Oscillator frequency	F <sub>OSC</sub>	10	—	800	kHz

## ●Block diagram



## ●Pin descriptions

Pin No.	Pin name	Function
1	CT	External timing capacitor
2	RT	External timing resistor
3	NON1	Positive input for error amplifier 1
4	INV1	Negative input for error amplifier 1
5	FB1	Error amplifier 1 output
6	DT1	Output 1 dead time / soft start setting
7	OUT1	Output 1
8	GND	Ground
9	Vcc	Power supply
10	OUT2	Output 2
11	DT2	Output 2 dead time / soft start setting
12	FB2	Error amplifier 2 output
13	INV2	Negative input for error amplifier 2
14	NON2	Positive input for error amplifier 2
15	SCP	Time latch setting
16	Vref	Reference voltage output (2.5V)

●Electrical characteristics (unless otherwise noted, Ta = 25°C, and V<sub>CC</sub> = 6V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
〈Reference voltage block〉						
Output voltage	V <sub>ref</sub>	2.4	2.5	2.6	V	I <sub>ref</sub> =1mA
Input stability	V <sub>DLI</sub>	—	1	10	mV	V <sub>CC</sub> =3.6~35V
Load stability	V <sub>DLO</sub>	—	1	10	mV	I <sub>ref</sub> =0~5mA
〈Triangular wave oscillator〉						
Oscillation frequency	F <sub>OSC</sub>	320	400	480	kHz	R <sub>RT</sub> =10kΩ, C <sub>CT</sub> =220pF
Frequency deviation	F <sub>DV</sub>	—	1	—	%	V <sub>CC</sub> =3.6~35V
〈Protection circuit〉						
Threshold voltage	V <sub>IT</sub>	1.48	1.64	1.80	V	—
Standby voltage	V <sub>STB</sub>	—	50	100	mV	No pull up
Latch voltage	V <sub>LT</sub>	—	30	100	mV	No pull up
Source current	I <sub>SCP</sub>	1.5	2.5	3.5	μA	—
Comparator threshold voltage	V <sub>CT</sub>	0.9	1.05	1.2	V	5pin, 12pin
〈Rest period adjustment circuit〉						
Input threshold voltage (f <sub>OSC</sub> = 10kHz)	V <sub>I0</sub>	1.79	1.97	2.15	V	Duty cycle=0%
	V <sub>I100</sub>	1.32	1.48	1.64	V	Duty cycle=100%
On duty cycle	D <sub>ON</sub>	45	55	65	%	Divide V <sub>ref</sub> usung 13kΩ and 27kΩ
Input bias current	I <sub>BDT</sub>	—	0.1	1	μA	DT1, DT2=2.0V
Latch mode source current	I <sub>DT</sub>	200	560	—	μA	DT1, DT2=0V
Latch input voltage	V <sub>DT</sub>	2.28	2.48	—	V	I <sub>DT</sub> =40 μA
〈Low-voltage input miss-operation prevention circuit〉						
Threshold voltage	V <sub>UT</sub>	—	2.53	—	V	—
〈Error amplifier〉						
Input offset voltage	V <sub>IO</sub>	—	—	6	mV	—
Input offset current	I <sub>IO</sub>	—	—	30	nA	—
Input bias current	I <sub>IB</sub>	—	15	100	nA	—
Open circuit gain	A <sub>V</sub>	70	85	—	dB	—
Common-mode input voltage range	V <sub>OM</sub>	0.3	—	1.6	V	V <sub>CC</sub> =3.6~35V
Common-mode rejection ratio	CMRR	60	80	—	dB	—
Maximum output voltage	V <sub>OH</sub>	2.3	2.5	—	V	—
Minimum input voltage	V <sub>OL</sub>	—	0.7	0.9	V	—
Output sink current	I <sub>OI</sub>	3	20	—	mA	FB=1.25V
Output source current	I <sub>OO</sub>	45	75	—	μA	FB=1.25V
〈PWM comparator〉						
Input threshold voltage (f <sub>OSC</sub> = 10kHz)	V <sub>I0</sub>	1.79	1.97	2.15	V	Duty cycle=0%
	V <sub>I100</sub>	1.32	1.48	1.64	V	Duty cycle=100%

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Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
〈Output block〉						
Saturation voltage	$V_{SAT}$	—	0.8	1.2	V	$I_o=75mA$
Leak current	$I_{LEAK}$	—	0	5	$\mu A$	$V_o=35V$
〈Total device〉						
Standby current	$I_{CCS}$	—	1.3	1.8	mA	When output is off
Average current consumption	$I_{CCA}$	—	1.6	2.3	mA	$R_{RT}=10k\Omega$

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●Timing chart

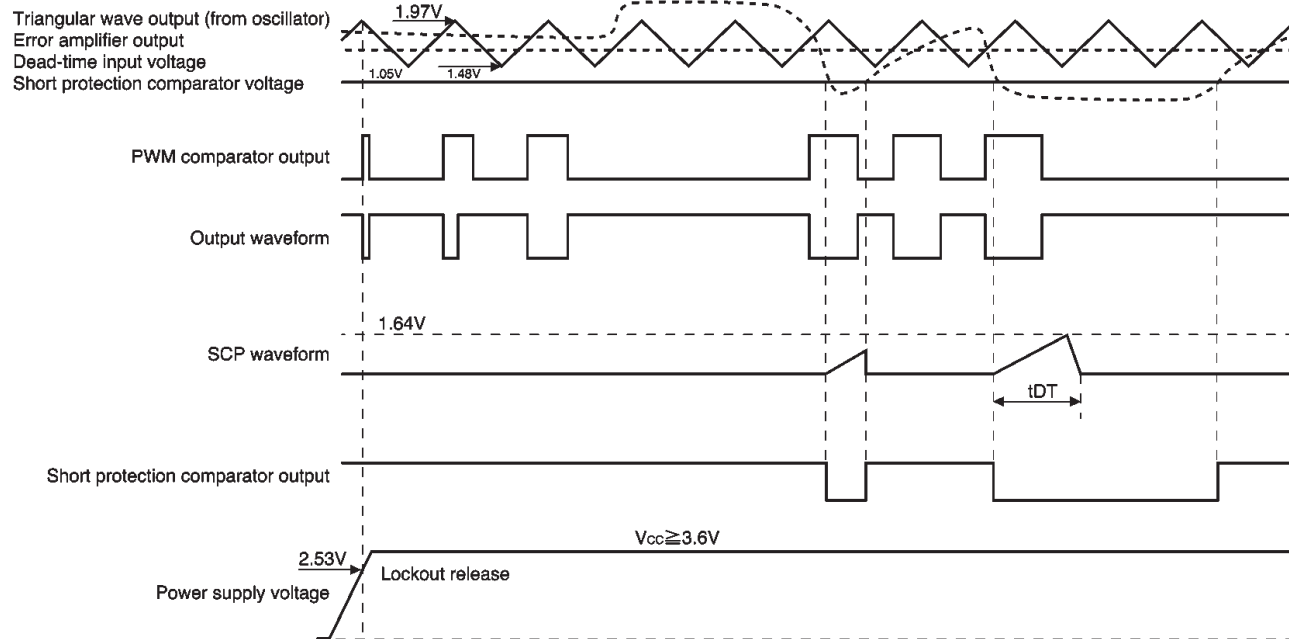


Fig.1

●Electrical characteristic curves

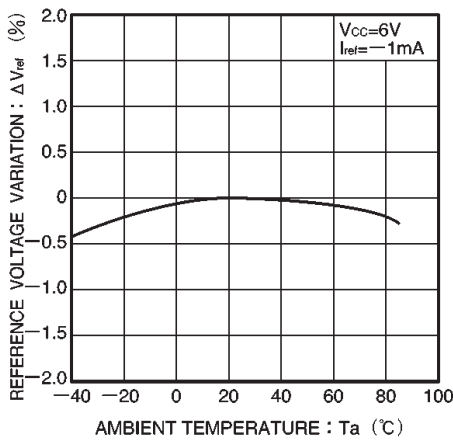


Fig.2 Reference voltage vs. ambient temperature

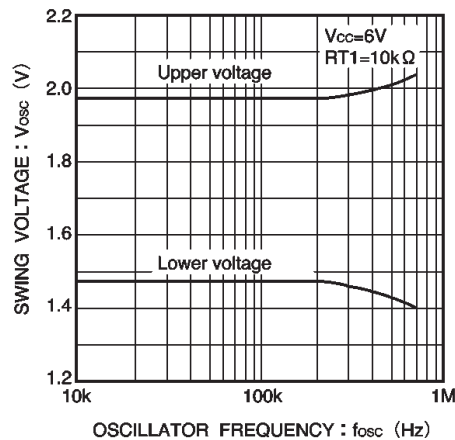


Fig.3 Swing voltage vs. frequency

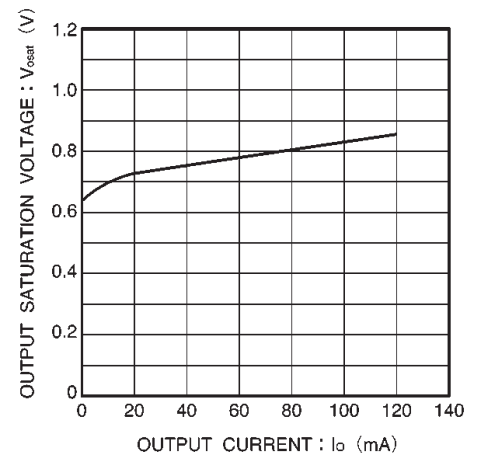


Fig.4 Output current vs. output saturation voltage

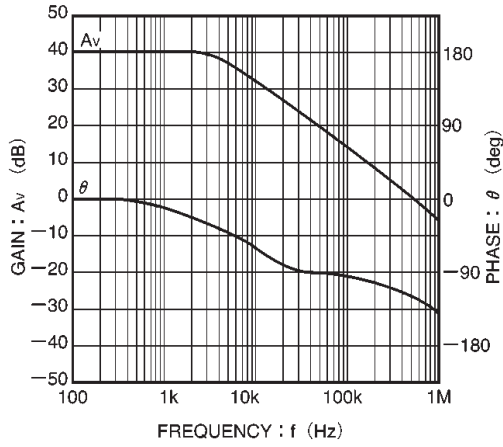


Fig.5 Error amplifier AC gain characteristic (40dB close)

● External dimensions (Units: mm)

