

# 2-channel switching regulator controller

## BA9744FV

The BA9744FV is a 2-channel switching regulator controller that uses the PWM method. Both circuits can be used for DC/DC conversion for step-up, step-down, and inverting. The IC comes in an extremely 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 (1.222V).
- 5) Reset 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	P <sub>d</sub>	450*1	mW
Operating temperature	T <sub>opr</sub>	-40~+85	°C
Storage temperature	T <sub>stg</sub>	-55~+125	°C
Output current	I <sub>o</sub>	60*2	mA
Output voltage	V <sub>o</sub>	36	V

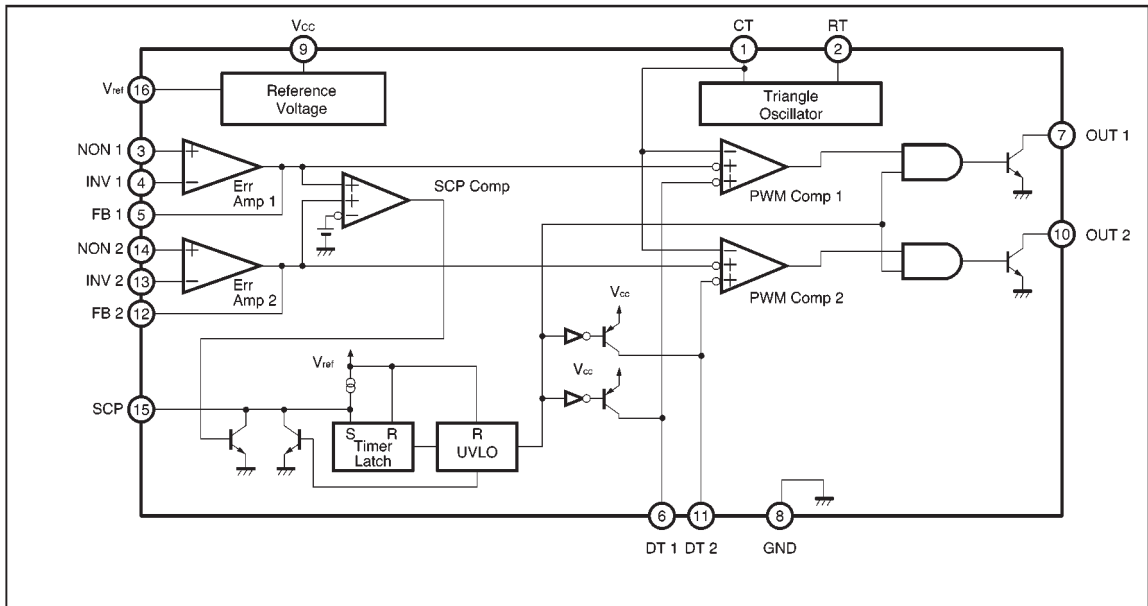
\*1 Reduced by 4.5mW for each increase in Ta of 1°C over 25°C (when mounted on a 50mm×50mm×1.6mm PC board).

\*2 Should not exceed Pd or ASO values.

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

Parameter	Symbol	Min.	Typ.	Max.	Unit.
Power supply voltage	V <sub>CC</sub>	2.5	3.0	35	V
Output current	I <sub>o</sub>	—	—	30	mA
Output voltage	V <sub>o</sub>	—	—	35	V
Error amplifier input voltage	V <sub>OM</sub>	0.3	—	1.5	V
Timing capacitor	C <sub>CT</sub>	100	—	15000	pF
Timing resistor	R <sub>RT</sub>	3	—	15	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	Output for error amplifier 1
6	DT1	Output 1 dead time/soft start setting
7	OUT1	Output 1
8	GND	Ground
9	V <sub>cc</sub>	Power supply
10	OUT2	Output 2
11	DT2	Output 2 dead time / soft start setting
12	FB2	Output for error amplifier 2
13	INV2	Negative input for error amplifier 2
14	NON2	Positive input for error amplifier 2
15	SCP	Timer latch setting
16	V <sub>ref</sub>	Reference voltage output (1.222V)

## ●Electrical characteristics (unless otherwise noted, Ta = 25°C, and Vcc = 3V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
〈Reference voltage block〉						
Output voltage	V <sub>ref</sub>	1.210	1.222	1.234	V	I <sub>ref</sub> =1mA
Input stability	V <sub>DLI</sub>	—	3	10	mV	V <sub>CC</sub> =2.5~35V
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> =5.1kΩ, C <sub>CT</sub> =220pF
Frequency deviation	F <sub>dv</sub>	—	1	—	%	V <sub>CC</sub> =2.5~35V
〈Protection circuit〉						
Threshold voltage	V <sub>IT</sub>	0.98	1.18	1.38	V	—
Standby voltage	V <sub>STB</sub>	—	50	100	mV	No pull up
Latch voltage	V <sub>LT</sub>	—	23	100	mV	No pull up
Source current	I <sub>SCP</sub>	1.0	2.0	3.0	μA	—
Comparator threshold voltage	V <sub>CT</sub>	0.15	0.25	0.35	V	5pin, 12pin
〈Rest period adjustment circuit〉						
Input threshold voltage (f <sub>osc</sub> =10kHz)	V <sub>IO</sub>	0.96	1.01	1.06	V	Duty cycle=0%
	V <sub>I100</sub>	0.46	0.49	0.52	V	Duty cycle=100%
On duty cycle	D <sub>ON</sub>	45	55	65	%	Divide V <sub>ref</sub> using 4.7kΩ and 7.5kΩ
Input bias current	I <sub>BDT</sub>	—	0.1	1	μA	DT1, DT2=2.0V
Latch mode source current	I <sub>DT</sub>	390	780	—	μA	DT1, DT2=0V
Latch input voltage	V <sub>DT</sub>	V <sub>CC</sub> -0.5	V <sub>CC</sub> -0.04	—	V	I <sub>DT</sub> =40 μA
〈Low-voltage input miss-operation prevention circuit〉						
Threshold voltage	V <sub>UT</sub>	1.6	1.9	2.2	V	—
〈Error amplifier〉						
Input offset voltage	V <sub>IO</sub>	—	0	6	mV	—
Input offset current	I <sub>IO</sub>	—	0	30	nA	—
Input bias current	I <sub>IB</sub>	—	15	100	nA	—
Open loop gain	AV	65	85	—	dB	—
Common-mode input voltage range	V <sub>OM</sub>	0.3	—	1.5	V	V <sub>CC</sub> =2.5~35V
Common-mode rejection ratio	CMRR	60	80	—	dB	—
Maximum output voltage	V <sub>OH</sub>	1.5	2.0	—	V	—
Minimum output voltage	V <sub>OL</sub>	—	0.1	0.3	V	—
Output sink current	I <sub>OI</sub>	1	2.1	—	mA	FB=0.75V
Output source current	I <sub>OO</sub>	50	70	90	μA	FB=0.75V
〈PWM comparator〉						
Input threshold voltage (f <sub>osc</sub> =10kHz)	V <sub>IO</sub>	0.96	1.01	1.06	V	Duty cycle=0%
	V <sub>I100</sub>	0.46	0.49	0.52	V	Duty cycle=100%

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
〈Output block〉						
Saturation voltage 1	V <sub>SAT1</sub>	—	0.06	0.3	V	I <sub>o</sub> =10mA
Saturation voltage 2	V <sub>SAT2</sub>	—	0.15	0.4	V	I <sub>o</sub> =30mA
Leak current	I <sub>LEAK</sub>	—	0	5	μA	V <sub>o</sub> =35V
〈Total device〉						
Standby current	I <sub>CCS</sub>	—	3.6	5.0	mA	When output is off
Average current consumption	I <sub>CCA</sub>	—	3.9	5.6	mA	R <sub>RT</sub> =5.1kΩ

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●Timing chart

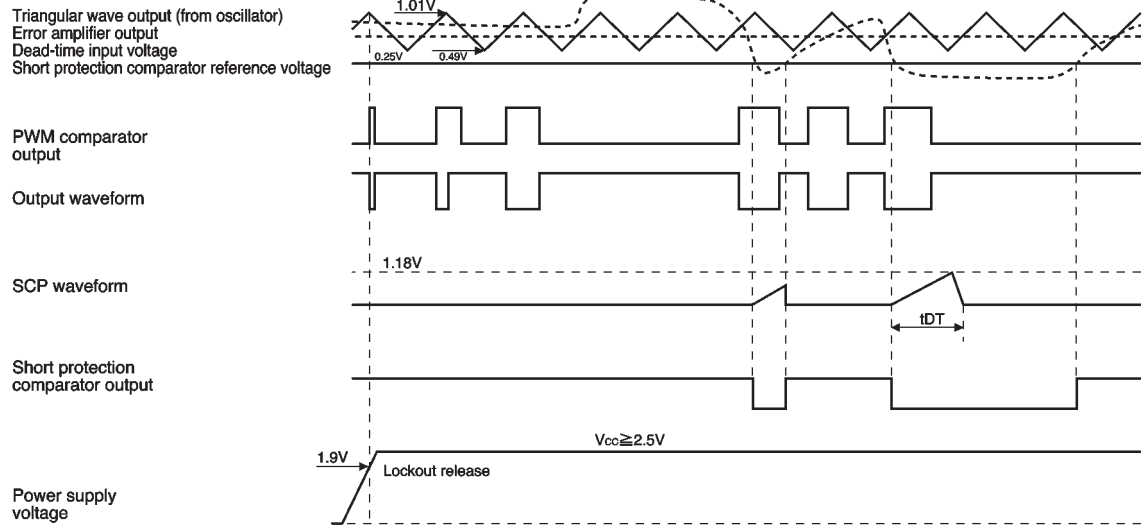


Fig.1

●Electrical characteristic curves

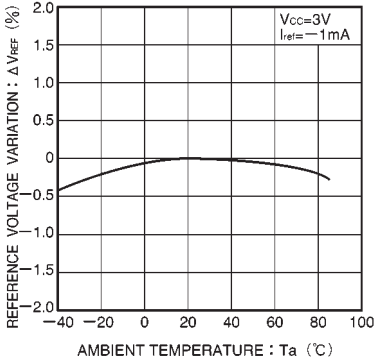


Fig.2 Reference voltage vs. ambient temperature

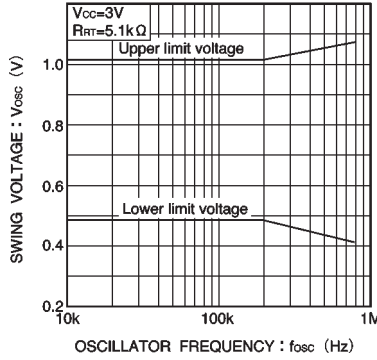


Fig.3 Swing voltage vs. frequency

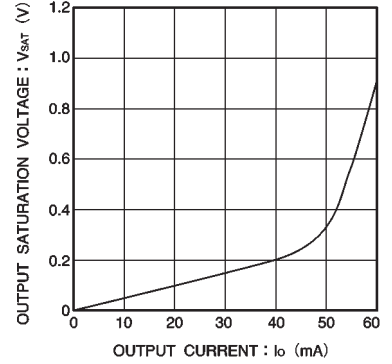


Fig.4 Output current vs. output saturation voltage

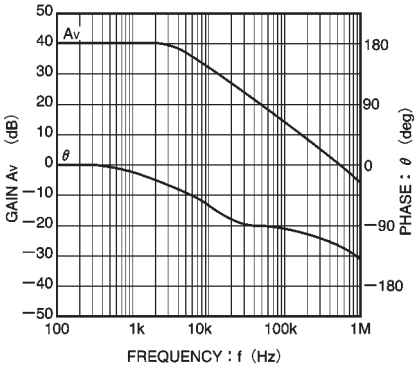


Fig.5 Error amplifier AC gain characteristic (40dB close)

●External dimensions (Units: mm)

