4-channel switching regulator controller

BA9737KV

The BA9737KV is a 4-channel controller that includes all of the circuits required to construct a switching regulator. The circuits on the chip include a triangular-wave oscillator, a reference voltage circuit, an error amplifier, a PWM comparator, a pseudo-totem-pole driver, and a short-circuit protection circuit.

●Applications
Camcoders and digital still cameras etc.

●Features
1) The totem-pole driver can directly drive power transistors, and the on current can be set to the rating current using an external resistor.
   For the off current, the peak current can be set using an external capacitor.
2) Output cutoff circuit (timer latch type) for overload protection.

3) Channels 2 and 3 are supplied using the internal reference voltage, and use a positive voltage only. Channels 1 and 4 are general-purpose channels, and all inputs are externally available.
4) Channels can be switched off individually or all together (STB and STB1 to STB4).
5) Dead-time control is provided for all channels, and duty limits can be used.

●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	12.5	V
Power dissipation	Pd	400*	mW
Operating temperature	Topr	$-25\sim+85$	℃
Storage temperature	Tstg	$-55\sim+125$	℃

∗1 Reduced by 4.0mW for each increase in Ta of 1°C over 25°C.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit.
Power supply voltage	V_{CC}	2.5	–	12	V
Oscillator frequency	fosc	10.0	–	700	kHz
Output current	Iout	–	–	30	mA

ROHM

●Block diagram
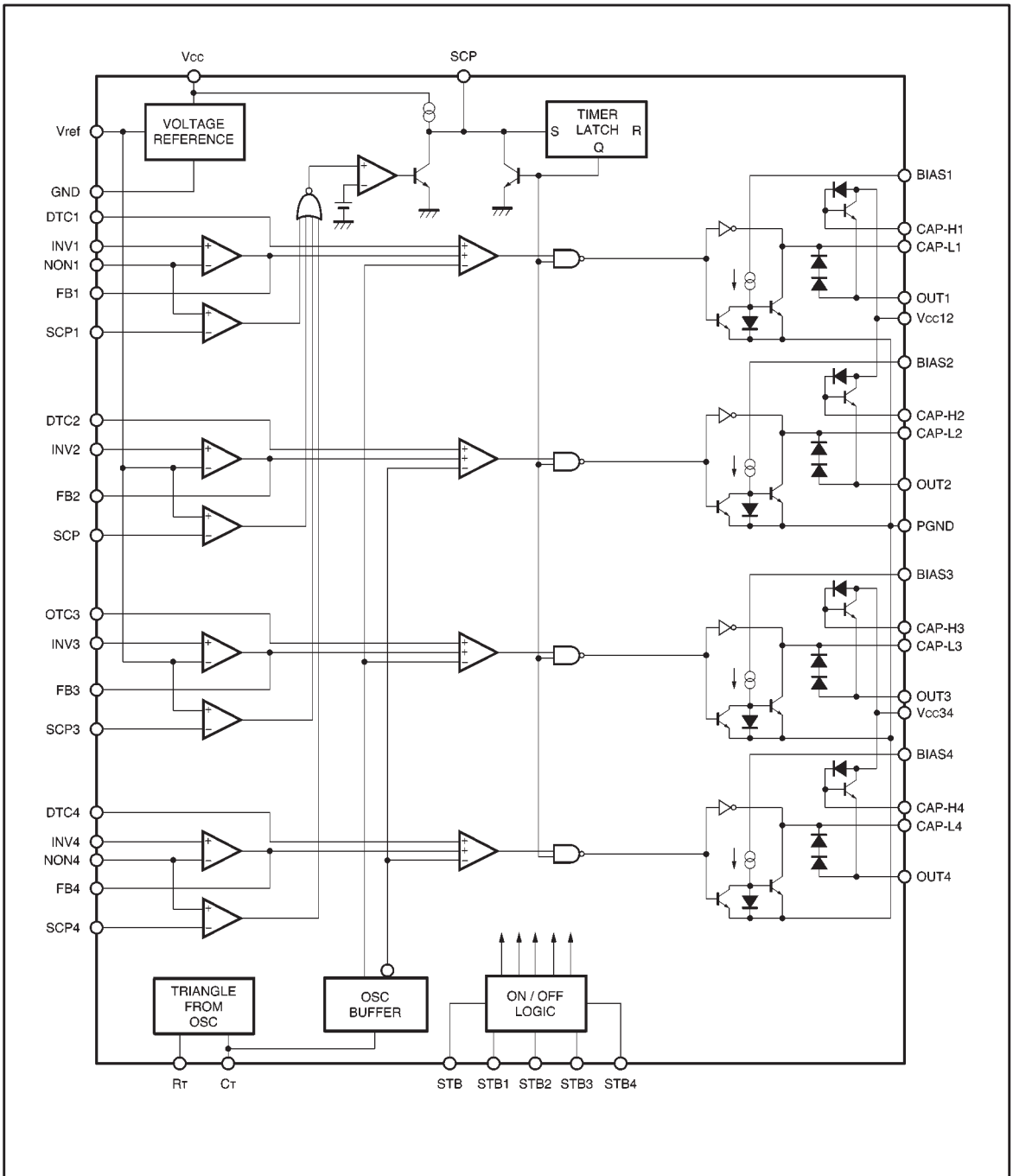
●Pin assignments
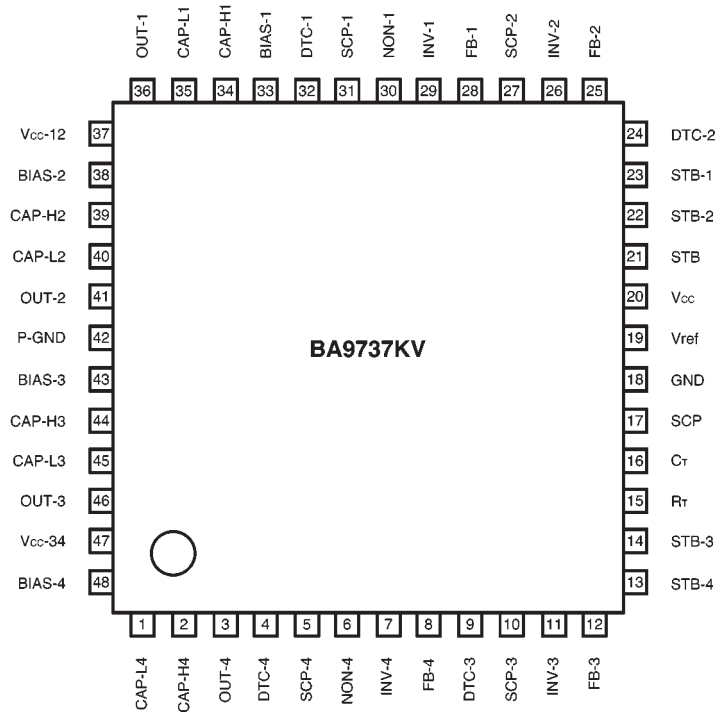
●Pin descriptions

Pin No.	Pin name	Function
2, 34, 39, 44	CAP-H4, 1, 2, 3	H connection for off transistor current-setting capacitor
1, 35, 40, 45	CAP-L4, 1, 2, 3	L connection for off transistor current-setting capacitor
3, 36, 41, 46	OUT-4, 1, 2, 3	Power transistor base connection
4, 9, 24, 32	DTC-4, 3, 2, 1	Dead time control
5, 10, 27, 31	SCP-4, 3, 2, 1	Output voltage monitor for channels 1 to 4 protection
6, 30	NON-4, 1	Non-inverting input for error amplifier
7, 11, 26, 29	INV-4, 3, 2, 1	Inverting input for error amplifier
8, 12, 25, 28	FB-4, 3, 2, 1	Error amplifier output
13, 14, 22, 23	STB-4, 3, 2, 1	Channel 1 to channel 4 on / off switches
15	R_T	Connection for resistor for triangular-wave timing
16	C_T	Connection for capacitor for triangular-wave timing
17	SCP	Connection for capacitor for setting timing latch delay
18	GND	Ground
19	Vref	Reference voltage output
20	Vcc	Power supply input
21	STB	All channel on / off switches
33, 38, 43, 48	BIAS-1, 2, 3, 4	Output current setting
37	Vcc-12	Power supply input for channels 1 and 2 output stages
42	P-GND	Ground connection for all output stages
47	Vcc-34	Power supply input for channels 3 and 4 output stages

●Electrical characteristics　(unless otherwise noted, Ta = 25°C, Vcc = 6.0V, fosc = 0.45MHz, STB, STB1 to STB4 = 5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Standby current	Ist	−	1	10	μA	STB, STB1〜4＝0V
Circuit current	Icc	−	7.5	10.2	mA	−
〈Error amplifier〉						
Output low level voltage	VOL	−	−	0.2	V	VINV＝2V
Output high level voltage	VOH	Vref −0.1	−	−	V	VINV＝0V
〈PWM comparator〉						
DTC input current	IDT	−	−1	−5	μA	VD＝0V
0％ DUTY threshold	Vt0	0.38	0.48	0.58	V	V1：DUTY0％
100％ DUTY threshold	Vt100	1.08	1.18	1.28	V	V1：DUTY100％
〈Output stage〉						
Output sink current	IOUT	4.0	5.8	7.5	mA	RBIAS＝10kΩ
〈Reference voltage〉						
Output voltage	Vref	1.485	1.5	1.515	V	Iref＝−1mA
Line regulation	DVLI	−	2.0	12.5	mV	Vcc＝2.5V〜12V
Load regulation	DVLC	−	1.0	7.5	mV	Iref＝−0.1mA〜−1mA
Short-circuit output current	IOS	4	26	−	mA	Vref＝0V
〈Overload cutoff〉						
Channel 1 threshold	VSC1	1.47	1.5	1.53	V	VS1＝2V〜1V
Channel 2 threshold	VSC2	1.47	1.5	1.53	V	VS2＝2V〜1V
Channel 3 threshold	VSC3	1.47	1.5	1.53	V	VS3＝2V〜1V
Channel 4 threshold	VSC4	1.47	1.5	1.53	V	VS4＝2V〜1V
〈Protection circuit〉						
Input threshold	VtSC	0.95	1.0	1.05	V	VSC＝0V〜1.5V
Standby voltage	VSSC	−	120	170	mV	−
Input source current	ISCP	−2	−4	−6	μA	VSC＝0.1V
〈Triangular wave oscillator〉						
Oscillation frequency　(1)	fOSC1	0.385	0.45	0.475	MHz	RT＝47kΩ, CT＝100pF
Oscillation frequency　(2)	fOSC2	0.63	0.70	0.77	MHz	RT＝27kΩ, CT＝100pF
Frequency deviation	Df	−	1	5	％	Vcc＝2.5V→12V
RT voltage	VRT	0.35	0.45	0.55	V	−
CT sink current	ICSC	26.6	38	49.4	μA	VCT＝1.7V
CT source current	ICSI	−26.6	−38	−49.4	μA	VCT＝0.9V

●Operation notes

(1) Use short and wide wiring tracks for the power supply and ground to keep the mutual impedance as small as possible, and use inductors and capacitors to keep ripple to a minimum.

(2) Great care has been paid to the quality of this component. However, if the absolute maximum ratings for temperature and applied voltage are exceeded, the IC may be destroyed.

Since it is not possible to predict whether it will be in short mode or open mode if the IC is destroyed, if there is a chance that the maximum ratings of the IC will be exceeded, use appropriate physical protective measures (fuses etc.).

(3) Set the dead-time input voltage to 0.58V or more.

(4) This IC does not use an internal circuit to generate the output on peak current, so we recommend that you connect capacitors to each end of R$_{BIAS}$ to externally generate the on peak current (after taking power dissipation and efficiency into consideration). In this case, there is a possibility that the output waveform may become unstable due to the current impedance, so we recommend that you connect resistors (of about 100Ω to 500Ω) in series with the off peak capacitors.

●External dimensions (Units: mm)

VQFP48