4-channel switching regulator BA9710KV

The BA9710KV, a 4-channel switching regulator that uses a pulse width modulation (PWM) system, can drive all channel PNP transistors directly. Channels 2 and 3 can be used for motor control because protection circuits are not built in.

Applications

VCRs and other portable equipment

Features

- 1) Reference voltage precision is $\pm 1\%$.
- Output stages are based on the push-pull method (resembling the totem-pole method), and ON and OFF currents can be set independently.
- 3) Triangular waves can be externally synchronized.
- Pins allow ON/OFF control of channels 3 and 4, or all channels at once.

•Absolute maximum ratings (Ta = 25° C)

Parameter	Symbol	Limits	Unit
Power supply voltage	Vcc	14	V
Power dissipation	Pd	400*	mW
Operating temperature	Topr	-25~+75	ĉ
Storage temperature	Tstg	-55~+125	ĉ

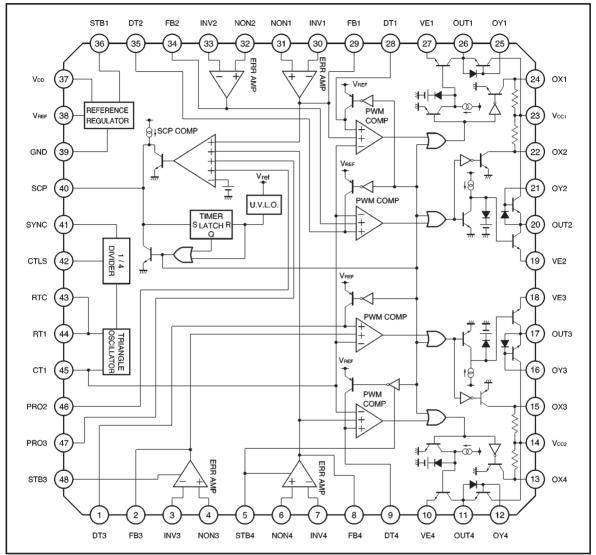
* Reduced by 4 mW for each increase in Ta of 1 $^\circ$ over 25 $^\circ$.

• Recommended operating conditions (Ta = 25° C)

Parameter	Symbol	Min.	Тур.	Max.	Unit
Power supply voltage	Vcc	3.5	6	12	V



Block diagram



Pin descriptions

Pin No.	Pin name	Functions
1, 9, 28 35	DT	Rest period setting pin; the rest period is set by dividing the VREF pin voltage with external resistors; a soft start is possible by connecting a capacitor between this pin and VREF.
2, 8, 29 34	FB	Error amplifier output pin; gain setting and phase compensation are controlled by connecting a resistor and capacitor between this pin and the INV.
3, 7, 30 33	INV	Error amplifier inverted input
4, 6, 31 32	NON	Error amplifier non-inverted input
5	STB4	Channel 4 ON/OFF pin; channel 4 operates when the pin is HIGH level; this pin is valid when STB1 is LOW level.
10, 18, 19 27	VE	Output current setting pin; output current is set by connecting a resistor between this pin and GND.
11, 17, 20 26	OUT	Output
12, 13, 15 16, 21, 22 24, 25	OX, OY	Output off current setting pin; output off current is set by connecting a capacitor between the OX and OY.
14, 23	Vcc	Output power supply
36	STB1	ON/OFF pin for all channels; stops the reference voltage and all channel operations when the pin is HIGH level.
37	VDD	Power supply
38	VREF	Reference voltage output
39	GND	Ground
40	SCP	Pin for connecting a time-constant setting capacitor in the short-circuit protection circuit; time constant for the timer-latched, short-circuit protection circuit is set by connecting a capacitor between this pin and GND.
41	SYNC	Pin for triangular wave external synchronization input; capacitor-coupled AC wave is input, and the triangular wave is synchronized with the 1/4 subharmonic oscillation of the input.
42	CTLS	ON/OFF pin for triangular wave external synchronization input; external synchronization circuit operates when the pin is HIGH level.
43	RTC	Pin for connecting a capacitor to stabilize the triangular wave oscillator constant current; noise of the constant current is reduced by connecting a capacitor between this pin and GND.
44	RT1	Pin for connecting a resistor to set the triangular wave oscillator frequency; oscillation frequency is set by connecting a resistor between this pin and GND.
45	CT1	Pin for connecting a capacitor to set the triangular wave oscillator frequency; oscillation frequency is set by connecting a capacitor between this pin and GND.
46	PRO2	Pin to set short-circuit protection in an arbitrary way; connected to VREF when not used.
47	PRO3	Pin to set short-circuit protection in an arbitrary way; connected to VREF when not used.
48	STB3	Channel 3 ON/OFF; channel 3 operates when this pin is HIGH level; this pin is valid when STB1 is LOW level.



BA9710KV

•Electrical characteristics (unless otherwise noted, $Ta = 25^{\circ}C$ and Vcc = 6V)

Parameter	Symbol	Min.	Тур.	Max.	Unit	Conditions
⟨Total device⟩				·	•	•
Average current dissipation 1	Icc1	-	5	7.5	mA	CTLS=0V
Average current dissipation 2	Icc2	-	6.5	10	mA	CTLS=6V
Standby current dissipation	Іств	-	40	60	μA	STB1=6V
(Control section)	•					1
STB1 ON condition	Vson	-	-	2.8	v	
STB1 OFF condition	Vsof	3.2	-	-	v	
STB1 pin current	ls1	15	30	45	μA	STB1=6V
STB3, 4, CTLS ON condition	Vcon	2	_	-	v	
STB3, 4, CTLS OFF condition	Vcof	-	-	1	v	
STB3, 4, CTLS pin current	lsc	50	100	150	μA	STB3, 4, CTLS=6V
$\langle Reference voltage section \rangle$	1					L
Output voltage	VREF	2.346	2.37	2.394	v	CTLS=6V, IREF=1mA
Input stability	VDLI	-	5	10	mV	Vcc=3.5→12V, CTLS=3V
Load regulation	VDLO	_	3	10	mV	IREF=0→10mA, CTLS=0V
$\langle Triangular wave oscillator section angle$	1	1	1	1	1	1
Oscillation frequency 1	Fosc1	370	435	500	kHz	RT=5.1k, CT=360P
Frequency variation 1 (Vcc)	F _{DVC1}	_	_	1	%	↓ Vcc=3.5→12V
Oscillation waveform upper limit voltage 1	V _{OSH1}	1.73	1.83	1.93	v	Ļ
Oscillation waveform lower limit voltage 1	V _{OSL1}	1.23	1.33	1.43	v	Ļ
Oscillation frequency 2	Fosc2	750	875	1000	kHz	RT=5.1k, CT=150P
Frequency variation 2 (Vcc)	FDVC2	-	_	1	%	↓ Vcc=3.5→12V
Oscillation waveform upper limit voltage 2	V _{OSH2}	1.79	1.89	1.99	v	Ļ
Oscillation waveform lower limit voltage 2	VosL2	1.22	1.32	1.42	v	Ļ
Oscillation frequency 3	Fosc3	1.5	1.75	2	MHz	RT=5.1k, CT=47P
Frequency variation 3 (Vcc)	FDVC3	_	_	1	%	↓ Vcc=3.5→12V
Oscillation waveform upper limit voltage 3	V _{OSH3}	1.89	1.99	2.09	v	Ļ
Oscillation waveform lower limit voltage 3	Vosla	1.19	1.29	1.39	v	Ļ
(Divider section)		1	1	1	1	1
SYNC pin maximum input frequency	FSYNC	_	_	5	MHz	
SYNC pin input voltage	VSYNC	0.2	_	0.8	VP-P	
(Error amplifier section)		I	1	1	1	1
Input offset voltage	Vio	-1.7	1.3	4.3	mV	In reference to the inverted input pin
Input offset current	lio	_	2	30	nA	· · ·
Input bias current	lıв	-	50	100	nA	
Open loop gain	Av	60	80	_	dB	
Common-mode rejection ratio	CMRR	60	80	_	dB	
Common-mode input voltage	Vом	0.3	_	1.6	V	
Maximum output voltage	Vон	2.1	2.4	- 1	v	
Minimum output voltage	Vos	_	700	850	mV	
Output sink current	loi	1.5	5	- 1	mA	
Output source current	loo	30	60	_	μA	



Parameter	Symbol	Min.	Тур.	Max.	Unit	Conditions
<pre></pre>		-				
Input threshold voltage	VIT	1.6	1.75	1.9	V	
Input standby voltage	VSTB	—	10	80	mV	
Input latch voltage	Vlt	—	10	80	mV	
Input source current	ISCP	1.1	2.1	3.1	μA	
Comparator threshold voltage	Vтс	0.9	1.0	1.1	V	
(U.V.L.O circuit section)						
Threshold voltage (VREF)	Vutr	1.7	1.85	2.0	V	
Threshold voltage (Vcc)	Vuтc	2.85	3.0	3.15	V	
$\langle Dead-time \ control \ section \rangle$						
Input bias current	Ірв	—	0.3	1.0	μA	
Source current when channel 4 is OFF	DF4	350	700	-	μA	
Latch mode source current	Idl	250	500	-	μA	
(Output section)						
Channel-1 pin voltage	Vo1	400	500	600	mV	RE=10Ω
Channel-1 pin voltage (IMax.)	Vом1	350	450	550	mV	$RE=5\Omega$
Channel-2, 3, 4 pin voltage	Vo	450	550	650	mV	RE=20Ω
Channel-2, 3, 4 pin voltage (IMax.)	Vом	400	500	600	mV	RE=10Ω

ONot designed for radiation resistance.

*Recommended operating power supply voltage: VCC = 3.5-12 V at Ta = 25° C

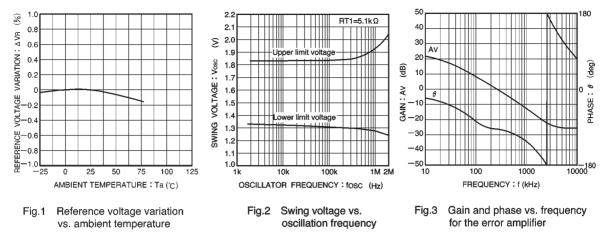
* Recommended maximum oscillation frequency: FMax. = 1 MHz at Ta = 25 $^\circ \!\! C$

•Reference data (unless otherwise noted, Ta = 25° C and Vcc = 6V)

Parameter	Symbol	Min.	Тур.	Max.	Unit	Conditions
(Output section)						
Channel-1 source peak current	IOP1	—	150	-	mA	
Channel-2, 3, 4 source peak current	Юр	_	120	-	mA	



Electrical characteristic curves



External dimensions (Units: mm)

