Regulator ICs

3-channel switching regulator BA9708K

The BA9708K, a 3-channel switching regulator that uses a pulse width modulation (PWM) system, can drive all channel PNP transistors directly.

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 / OFF currents can be set independently.
- 3) Triangular waves can be externally synchronized.
- 4) Pins allow ON / OFF control of channel 3 only, or all channels at once.

•Absolute maximum ratings (Ta = 25° C)

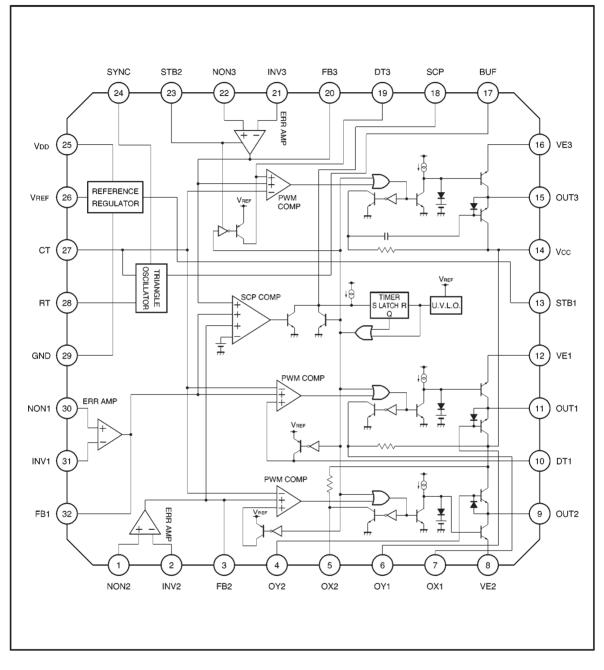
Parameter	Symbol	Limits	Unit
Power supply voltage	Vcc	14	V
Power dissipation	Pd	400*	mW
Operating temperature	Topr	-25~+75	ĉ
Storage temperature	Tstg	-55~+125	ĉ

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

• 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	Function
1	NON2	Channel 2 error amplifier non-inverted input
2	INV2	Channel 2 error amplifier inverted input
3	FB2	Channel 2 error amplifier output pin; gain setting and phase compensation are controlled by connecting a resistor and capacitor between this pin and the INV2
4	OY2	Channel 2 output transistor off current setting pin; output transistor off current is set by
5	OX2	connecting a capacitor between the OX2 and OY2
6	OY1	Channel 1 output transistor off current setting pin; output transistor off current is set by
7	OX1	connecting a resistor and capacitor
8	VE2	Channel 2 output current setting pin; output current of OUT2 is set by connecting a resistor between this pin and GND
9	OUT2	Channel 2 output
10	DT1	Channel 1 rest period setting pin; the rest period of channel 3 is set by dividing the VREF voltage with external resistors; a soft start is possible by connecting a capacitor between this pin and VREF
11	OUT1	Channel 1 output
12	VE1	Channel 1 output current setting pin; output current of OUT1 is set by connecting a resistor between this pin and GND
13	STB1	ON/OFF pin for all channels; stops the reference voltage and all channel operations when the pin is HIGH level
14	Vcc	Output power supply
15	OUT3	Channel 3 output
16	VE3	Channel 3 output current setting pin; output current of OUT3 is set by connecting a resistor between this pin and GND
17	BUF	Triangular wave external output pin, which makes triangular waves available to outside the IC
18	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
19	DT3	Channel 3 rest period setting pin; the rest period of channel 3 is set by dividing the V_{REF} pin voltage with external resistors; a soft start is possible by connecting a capacitor between this pin and V_{REF}
20	FB3	Channel 3 error amplifier output pin; gain setting and phase compensation are controlled by connecting a resistor and capacitor between this pin and the INV3
21	INV3	Channel 3 error amplifier inverted input
22	NON3	Channel 3 error amplifier non-inverted input
23	STB2	Channel 3 ON / OFF pin; channel 3 operates when the pin is HIGH level, and ceases operation at LOW level; this pin is valid when CTL1 is LOW level
24	SYNC	Pin for triangular wave external synchronization input; capacitor-coupled AC wave is input, and the triangular wave is synchronized with the input frequency; the GND pin is used in the case of self-oscillation
25	VDD	Power supply
26	Vref	Reference voltage output ; 2.4 V (typical)
27	СТ	Pin for connecting a frequency setting capacitor in the triangular wave oscillation circuit; triangular wave oscillation frequency is set by connecting a capacitor between this pin and GND
28	RT	Pin for connecting a frequency setting resistor in the triangular wave oscillation circuit; triangular wave oscillation frequency is set by connecting a resistor between this pin and GND



Pin No.	Pin name	Function
29	GND	Ground
30	NON1	Channel 1 error amplifier non-inverted input
31	INV1	Channel 1 error amplifier inverted input
32	FB1	Channel 1 error amplifier output pin; gain setting and phase compensation are controlled by connecting a resistor and capacitor between this pin and the INV1

•Electrical characteristics (unless otherwise noted, Ta = 25° C and V_{cc} = 6V)

Parameter	Symbol	Min.	Тур.	Max.	Unit	Conditions
〈Total device〉						
Average current dissipation	lcc	—	6	9	mA	STB1=0V, STB2=6V
Standby current dissipation	lsтв	—	40	60	μA	STB1=6V
(Control section)						
STB1 ON condition	Vs1N	-	-	2.8	V	
STB1 OFF condition	Vs1F	3.2	—	—	V	
STB1 pin current	ls1	15	30	45	μA	STB1=6V
STB2 ON condition	Vs2N	2	-	—	V	
STB2 OFF condition	Vs2F	-	-	1	V	
STB2 pin current	ls2	50	100	150	μA	STB2=6V
$\langle {\sf Reference voltage section} angle$						
Output voltage	VREF	2.376	2.400	2.424	V	IREF=1mA
Input stability	Vdli	—	5	10	mV	Vcc=3.5→12V
Load regulation	Vdlo	_	3	10	mV	I _{REF} =0→10mA
\langle Triangular wave oscillator section $ angle$						
Oscillation frequency	Fosc	490	540	590	kHz	RT=7.5k, CT=220P
Frequency variation (Vcc)	Fovc	_	-	1	%	↓ Vcc=3.5→12V
Oscillation waveform upper limit voltage	Vosh	1.82	1.92	2.02	V	Ļ
Oscillation waveform lower limit voltage	Vosl	1.24	1.34	1.40	V	Ļ
(Divider section)						
SYNC pin maximum input frequency	FSYNC	-	_	1.5	MHz	
SYNC pin input voltage	VSYNC	0.2	—	0.8	VP-P	

Parameter	Symbol	Min.	Тур.	Max.	Unit	Conditions
$\langle Error \ amplifier \ section angle$						
Input offset voltage	Vio	-3.3	0.7	4.7	mV	Inverted pin standard
Input offset current	lio	—	2	30	nA	
Input bias current	Ів	-	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	-	v	
Minimum output voltage	Vos	-	700	850	mV	
Output sink current	loi	1.5	5	-	mA	FB=1.0V
Output source current	loo	30	60	-	μA	FB=1.0V
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Input threshold voltage	VIT	1.6	1.8	1.9	V	
Input standby voltage	VSTB	_	10	80	mV	
Input latch voltage	VLT	_	10	80	mV	
Input source current	ISCP	200	400	600	nA	
Comparator threshold voltage	Vтc	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)	Vutc	2.7	2.85	3.0	V	
(Dead-time control section)						•
Input bias current	Ірв	-	0.3	1.0	μA	VDTC=2.0V
Source current when channel-3 is OFF	IDF3	350	700	-	μA	
Latch mode source current	IDL	250	500	-	μA	
(Output section)						
Channel-1 pin voltage	Vo1	450	550	650	mV	RE=15 Ω , Vcc=6V
Channel-1 pin voltage (I _{Max.})	Vom1	350	450	550	mV	RE= 3.3Ω , Vcc= $6V$
Channel-2 pin voltage	Vo2	400	500	600	mV	RE=33 Ω , Vcc=6V
Channel-2 pin voltage (I _{Max.})	Vom2	300	400	500	mV	RE= 5.6Ω , Vcc= $6V$
Channel-3 pin voltage	Vos	400	500	600	mV	$RE=47\Omega$, $Vcc=6V$
Channel-3 pin voltage (I _{Max.})	Vомз	300	400	500	mV	RE=8.2Ω, Vcc=6V

 $\bigcirc Not$ designed for radiation resistance.

* Recommended operating power supply voltage: Vcc = 3.5-12 V at Ta = 25 $^\circ\!\!C$

* Recommended maximum oscillation frequency: FMax. = 1 MHz at Ta = 25° C

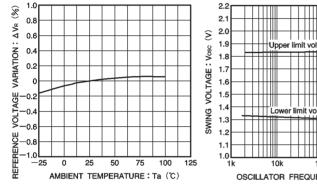
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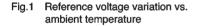
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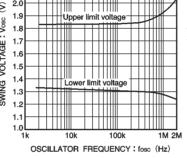
Parameter	Symbol	Min.	Тур.	Max.	Unit	Conditions
(Output section)					-	
Channel-1 source peak current	lop1	-	200	-	mA	
Channel-2 source peak current	lop2	_	130	-	mA	
Channel-3 source peak current	ЮРЗ	_	120	-	mA	

RT1=5.1kΩ

Electrical characteristic curves







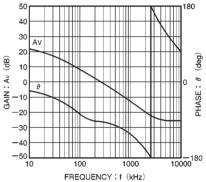


Fig.2 Swing voltage vs. oscillation frequency Fig.3 Gain and phase vs. frequency for the error amplifier (20 dB, close)

External dimensions (Units: mm)

