

HA17384PS/FP, HA17385PS/FP

Preliminary

Current Mode PWM Control Switching Regulator ICs

Description

The HA17384 series is a control IC for PWM (pulse width modulation) switching regulator. These ICs are suitable for primary control system, and the standby current are as small as 500 μ A (max.) These ICs enable the regulator set size to miniaturize, and to improve power efficiency of these sets. The HA17384 series is able to drive the POWER MOS FET directly and have higher switching frequency of up to 500 KHz max.

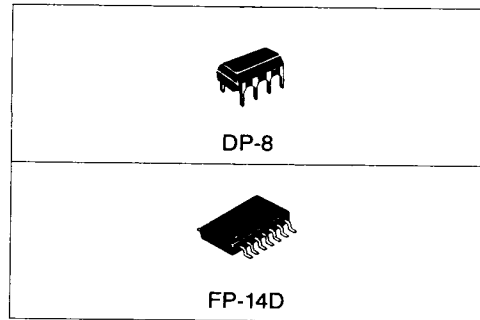
The two types of packages are DIP 8 and SOP 14 are provided for ICs.

Functions

- 5V reference voltage circuit
- Triangular waveform oscillation circuit
- PWM comparator circuit
- Output driver circuit (totem pole output)
- Error amp circuit
- Current sense comparator with 1 pulse latch
- Under voltage lock out protection

Features

- High speed switching:
 - $t_r = 50\text{nsec}$ (typ.) (at 15V swing)
 - $t_f = 50\text{nsec}$ (typ.) (at 15V swing)
- Low power dissipation:
 - 500 μ A max. in standby state
 - 17mA max. in active state (at $V_{IN} = 15\text{V}$)
- Under voltage lockout protection:
 - high threshold voltage: HA17384—16V
 - HA17385—10V
 - low threshold voltage: HA17384—10V
 - HA17385—8V
- Drive the POWER MOS FET directly:
 - output peak current 1.5A max.
- Output double pulse protection with a 1 pulse latched overcurrent protection circuit



Ordering Information

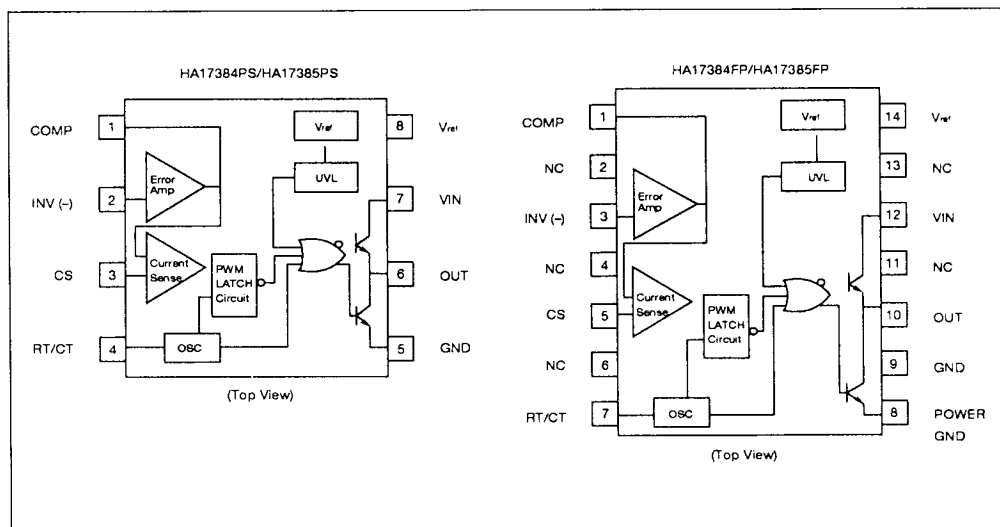
Type No.	Package
HA17384PS	DP-8
HA17384FP	FP-14D
HA17385PS	DP-8
HA17385FP	FP-14D

Pin Functions

Symbol	Pin No.		Functions
	384PS/ 385PS	384FP/ 385FP	
COMP	1	1	Error amp. compensation
INV (-)	2	3	Error amp. input (-)
CS	3	5	Current sense
RT/CT	4	7	Timing resistor, Timing capacitor
GND	5	8	Ground
OUT	6	10	Pulse output
V _{IN}	7	12	Input voltage
V _{REF}	8	14	Reference voltage (5V) output
P-GND	—	9	Power Ground



Block Diagram



Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating		Unit
		HA384PS/385PS	HA384FP/385FP	
Power Supply Voltage	VIN	+ 40	+ 40	V
Collector Current	DC	I _{odc}	push pull 0.3	A
	Peak	I _{opeak}	push pull 1.5***	A
Error Input Voltage	VE	-0.3 ~ +6.3	-0.3 ~ +6.3	V
Comparator Input Voltage	VC	-0.3 ~ +6.3	-0.3 ~ +6.3	V
Error Amp Output Current	IE	10	10	mA
Power Dissipation	PT	830*	830*	mW
Operation Temperature Range	T _{opr}	-20 to +85	-20 to +85	°C
Storage Temperature Range	T _{stg}	-55 ~ +125	-55 ~ +125	°C

The absolute maximum ratings are limiting values, to be applied individually, beyond which the device may be permanently damaged. Functional operation under any of these conditions is not guaranteed. Exposing a circuit to its absolute maximum rating for extended periods of time may affect the device's reliability.

- * This is the allowable loss value for a maximum rating up to Ta ≤ 25°C. If more than, 8.3mW/°C derating must be performed.
- ** Allowable temperature of IC junction, T_j (max.), is as shown below.
 $T_j(\text{max.}) = \theta_j - a \cdot P_c(\text{max.}) + T_a$
 (θ_j - a is thermal resistance value during board mounting, and P_c (max.) maximum value of IC power dissipation.)
 Therefore, to keep T_j (max.) 125°C, wiring density and board material must be selected according to the board thermal conductivity shown below.
 Be careful that the value of P_c (max.) does not exceed that of P_T.
- *** Value at a current flow period of 300nsec.



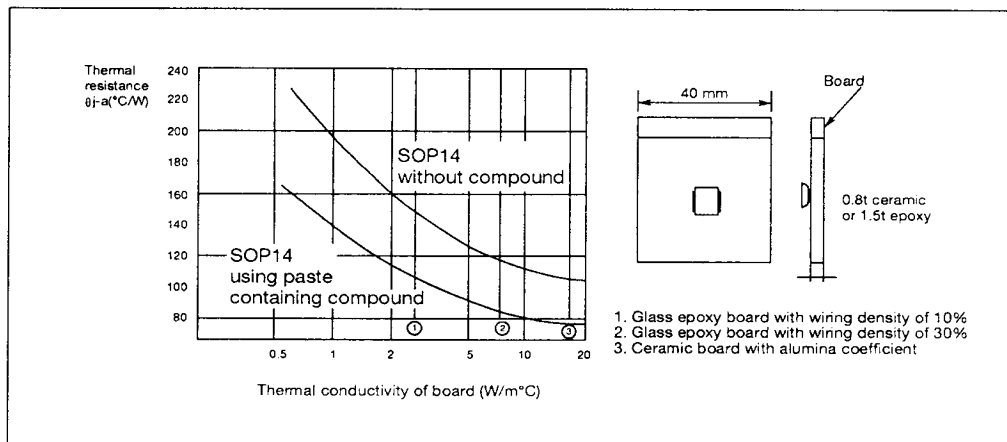


Figure 1. Thermal resistance of SOP

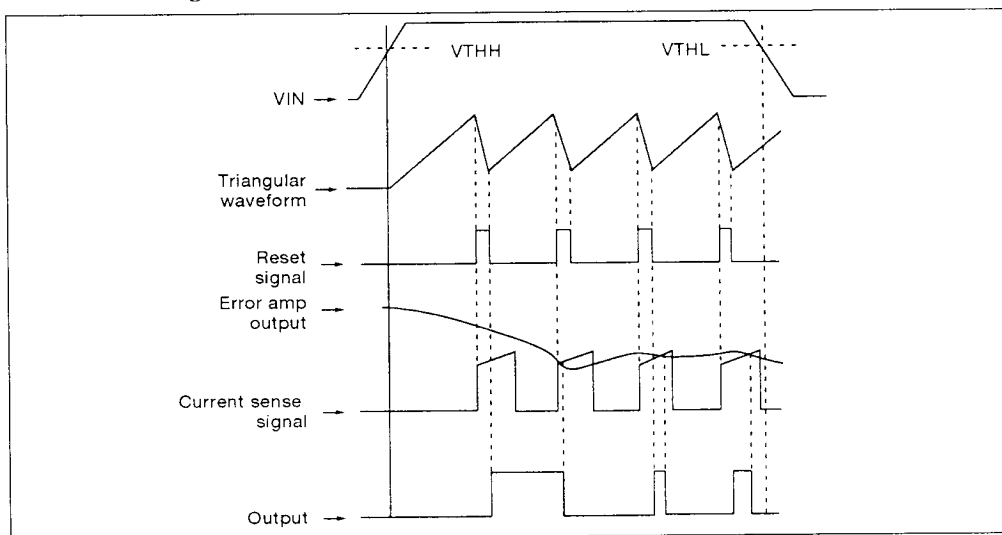
Electrical Characteristics ($V_{IN} = 15V$, $T_a = 25^\circ C$, $R_T = 10K\Omega$, $C_T = 3300pF$)

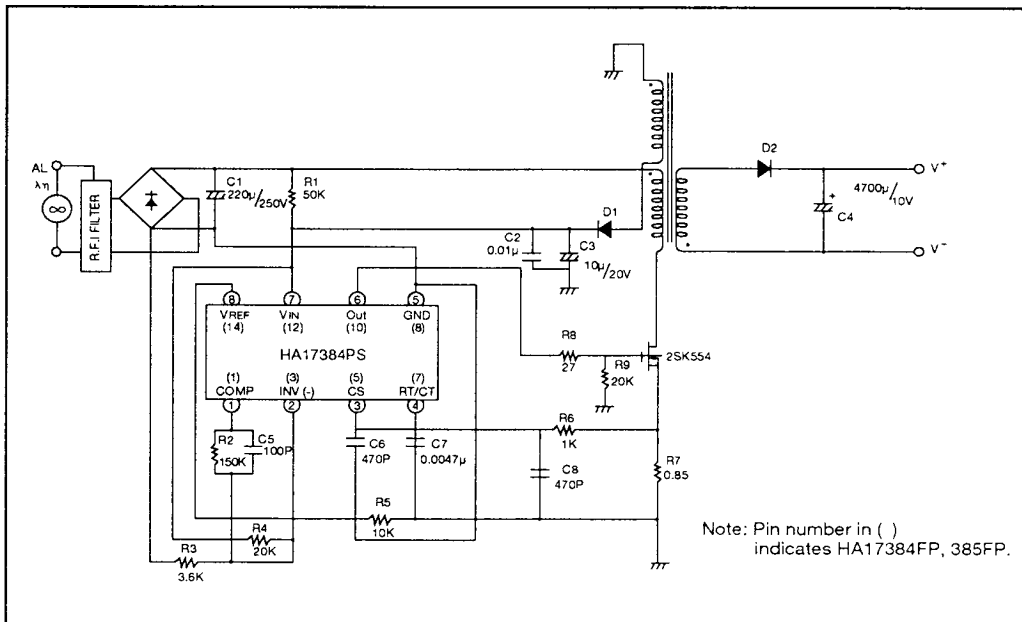
Section	Item	Symbol	Test Condition	min.	typ.	max.	Unit	Note
Reference Section	Output Voltage	V_{ref}	$I_o = 1mA$	4.85	5.00	5.15	V	
	Line Regulation	Line	$V_{IN} = 12 \text{ to } 40V$	—	6	20	mV	
	Load Regulation	Load	$I_o = 1 \text{ to } 20mA$	—	6	25	mV	
	Temperature Stability	V_{RTC}	No load	—	0.2	—	%	
	Output Noise Voltage	V_N	$10Hz \leq f \leq 10KHz$	—	50	—	μV	
	Short Circuit Current	I_{os}		30	100	180	mA	
Triangular Waveform Oscillation Section	Initial Accuracy	f_{dev}		47	52	57	KHz	
	Voltage Stability	f_r	$12V < V_{IN} < 40V$	—	0.2	1	%	
	Temperature Range	Δf	$-20^\circ C \leq T_a \leq 85^\circ C$	—	5	—	%	
	Amplitude	V_{osc}	① pin (⑦ pin) peak to peak	—	1.7	—	V	
Error Amp Section	Input Voltage	V_{Eih}	$V_{①} = 2.5V$	2.42	2.50	2.58	V	
	Input Bias Current	I_{B1}		—	0.3	2	μA	
	Open-Loop Voltage Gain	A_{vd}	$2V \leq V_o \leq 4V$	65	90	—	dB	
	Unity Gain Bandwidth	Bw		0.7	1.0	—	MHz	
	Power Supply Rejection Ratio	$PSRR$	$12V \leq V_{CC} \leq 40V$	60	70	—	dB	
	Output Sink Current	I_{sink}	$V_{②} (V_{③}) = 2.7V$, $V_{①} = 1.1V$	2	6	—	mA	1
	Output Source Current	I_{source}	$V_{②} (V_{③}) = 2.3V$, $V_{①} = 5V$	500	800	—	μA	1
	VOUT High	V_{OH}	$V_{②} (V_{③}) = 2.3V$, $R_L = 15K\Omega$ to ground	5	6	—	V	1
	VOUT Low	V_{OL}	$V_{②} (V_{③}) = 2.7V$, $R_L = 15K\Omega$ to V_{ref}	—	0.7	1.1	V	1
	Gain			2.85	3	3.15	V/V	
Comparator Section	Input Threshold Voltage	V_{ith}		0.9	1.0	1.1	V	
	Input Bias Current	I_{B2}		—	2	10	μA	
	Delay to Output	t_{r1}		—	150	300	ns	

Electrical Characteristics ($V_{IN} = 15V$, $T_a = 25^\circ C$, $R_T = 10K\Omega$, $C_T = 3300pF$) (Cont'd.)

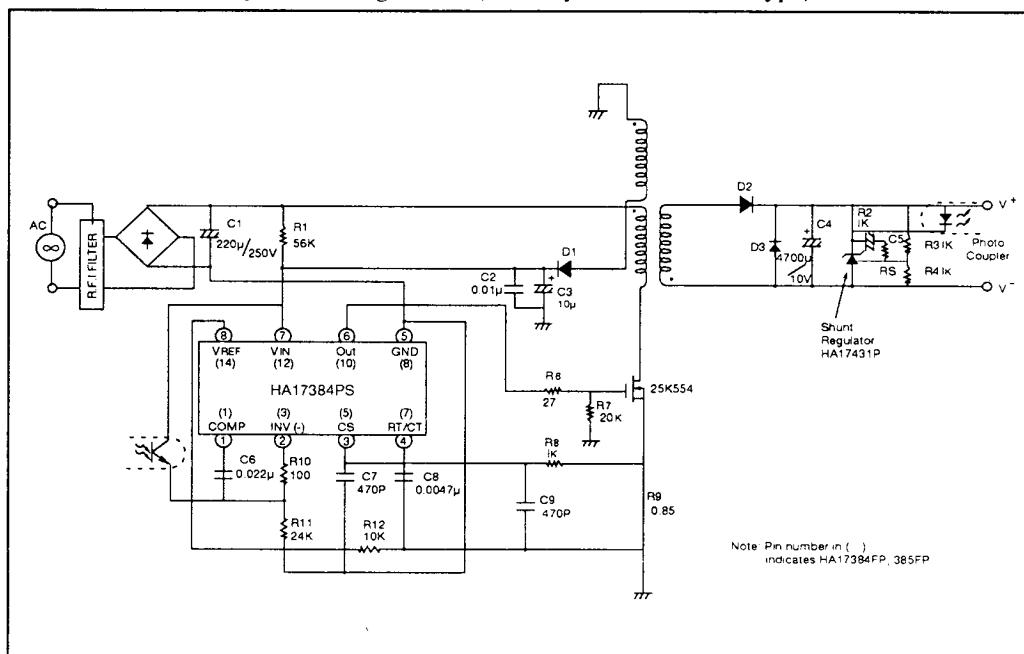
Section	Item	Symbol	Test Condition	min.	typ.	max.	Unit	Note
Output Section	Output High Level	V_{OH}	$I_{sink}20mA$	13	13.5	—	V	
	Output High Level	V_{OH}	$I_{sink}200mA$	12	13.5	—	V	
	Output Low Level	V_{OL}	$I_{source}20mA$	—	0.1	0.4	V	
	Output Low Level	V_{OL}	$I_{source}200mA$	—	1.5	2.2	V	
	Rise Time	t_r	$C_L = 1nF$	—	50	150	ns	
	Fall Time	t_f	$C_L = 1nF$	—	50	150	ns	
	Output Leak Current	I_{LO}	$V_{CC} = 14V$, $V_{(6)}$ ($V_{10} = 0V$, UVL active)	—	0.01	10	μA	1
	High Level Threshold	V_{THH}		14.5	16	17.5	V	
Total Current Section	Low Level Threshold	V_{THL}		8.5	10	11.5	V	
	Standby Current	I_{CS}		—	250	500	μA	
	Active Current	I_{CL}	$V_{(2)}(V_{(3)}) = 0V$, $V_{(3)}(V_{(6)}) = 0V$	—	10	15	mA	1

Note: 1. Pin number in () indicates HA17384FP, HA17385FP.

Waveform Timing



System Configuration (Primary Current Sense Type)

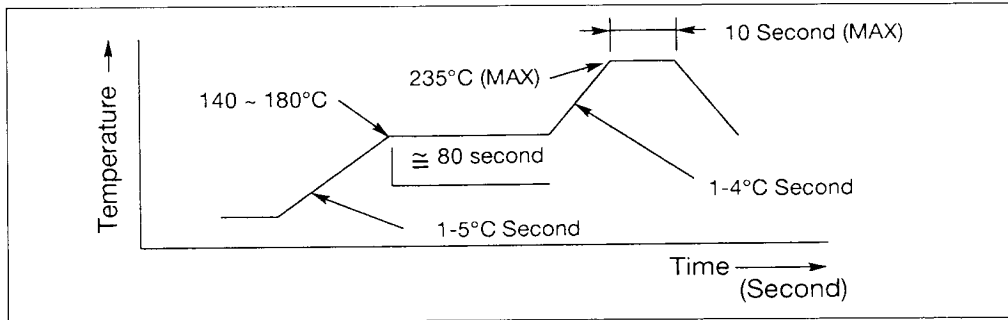


System Configuration (Secondary Current Sense Type)



Solder Mounting Method

- 1). Small and light surface-mount packages require special attentions on solder mounting. On solder mounting, pre-heating before soldering is needed. The following figure shows an example of infrared rays reflow.
- 2). The difference of thermal expansion coefficient between mounting substrates and IC lead may cause a failure like solder peeling or solder wet, and electrical characteristics may change by thermal stress. Therefore, mounting should be done after sufficient confirmation for especially in case of ceramic substrates.



An Example of Infrared Rays Reflow Conditions