

# HA17384PS/FP, HA17385PS/FP

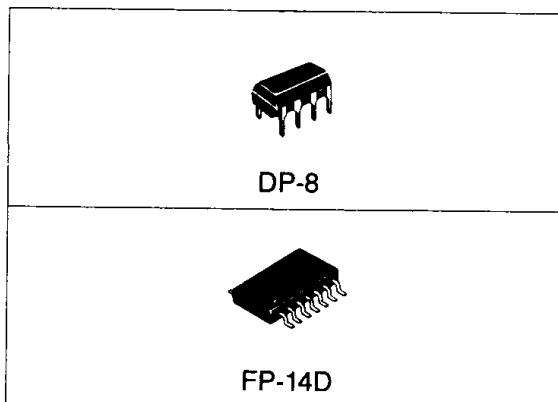
Preliminary

## 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  $\mu$ 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 $\mu$ A max. in standby state
  - 17mA max. in active state (at  $V_{IN} = 15V$ )
- 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

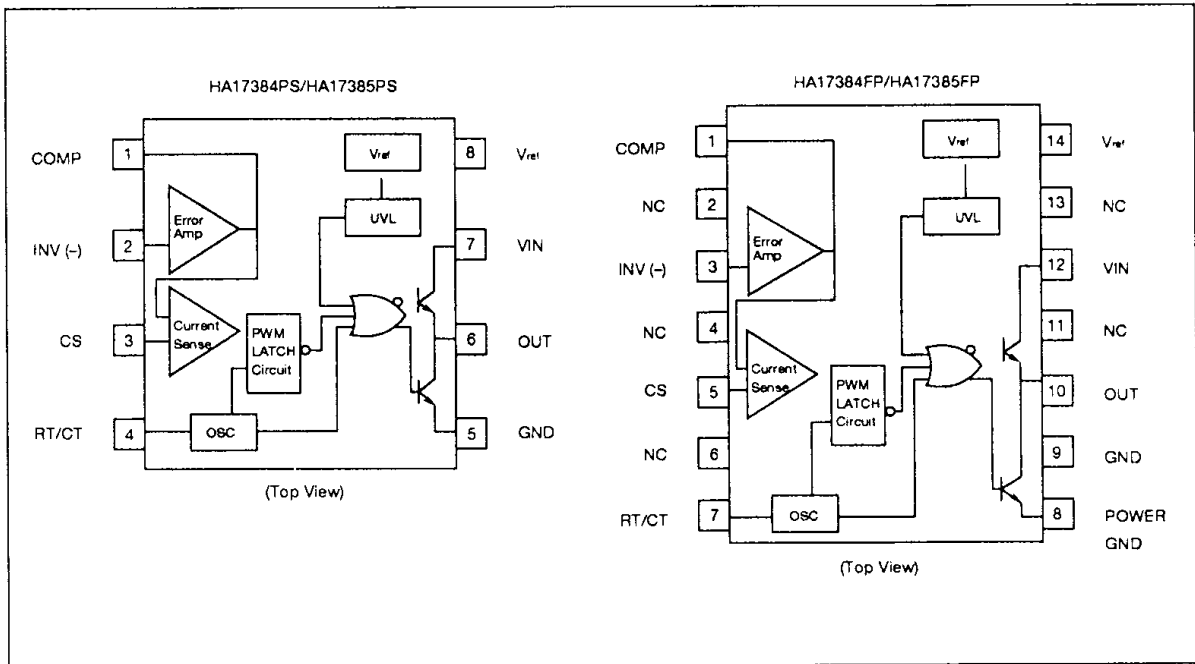
Type No.	Package
HA17384PS	DP-8
HA17384FP	FP-14D
HA17385PS	DP-8
HA17385FP	FP-14D

### 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
VREF	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 Iodc	push pull 0.3	push pull 0.3	A
	Peak Iopeak	push pull 1.5***	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	Topr	-20 to +85	-20 to +85	°C
Storage Temperature Range	Tstg	-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, Tj (max.), is as shown below.  
 $T_j(\text{max.}) = \theta_j - a \cdot P_c(\text{max.}) + T_a$   
 (θj - a is thermal resistance value during board mounting, and Pc (max.) maximum value of IC power dissipation.)  
 Therefore, to keep Tj (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 Pc (max.) does not exceed that of PT.
- \*\*\* Value at a current flow period of 300nsec.



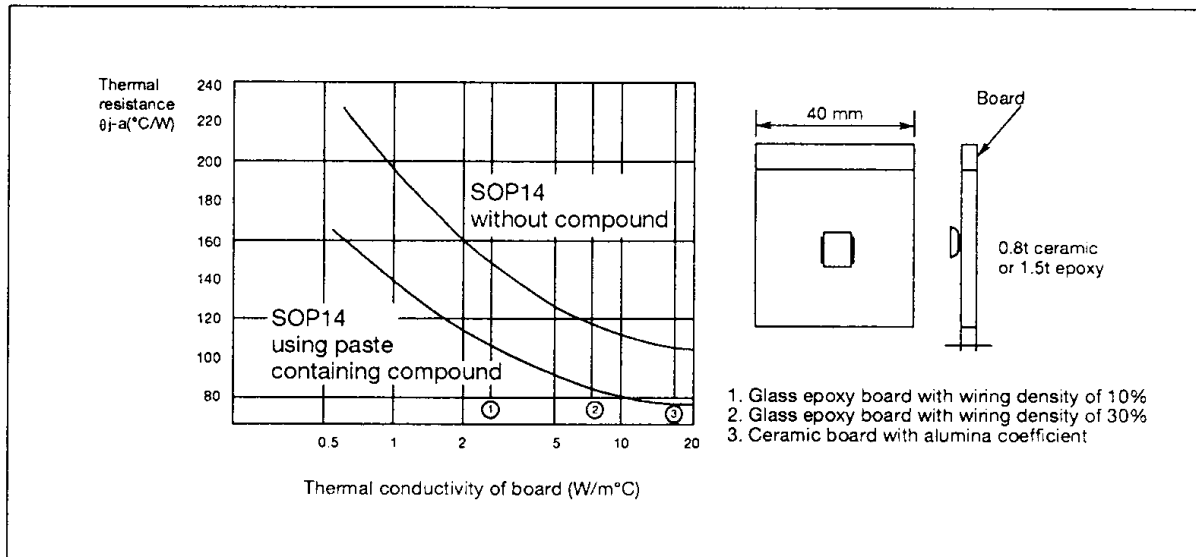


Figure 1. Thermal resistance of SOP

Electrical Characteristics (VIN = 15V, Ta = 25°C, RT = 10KΩ, CT = 3300pF)

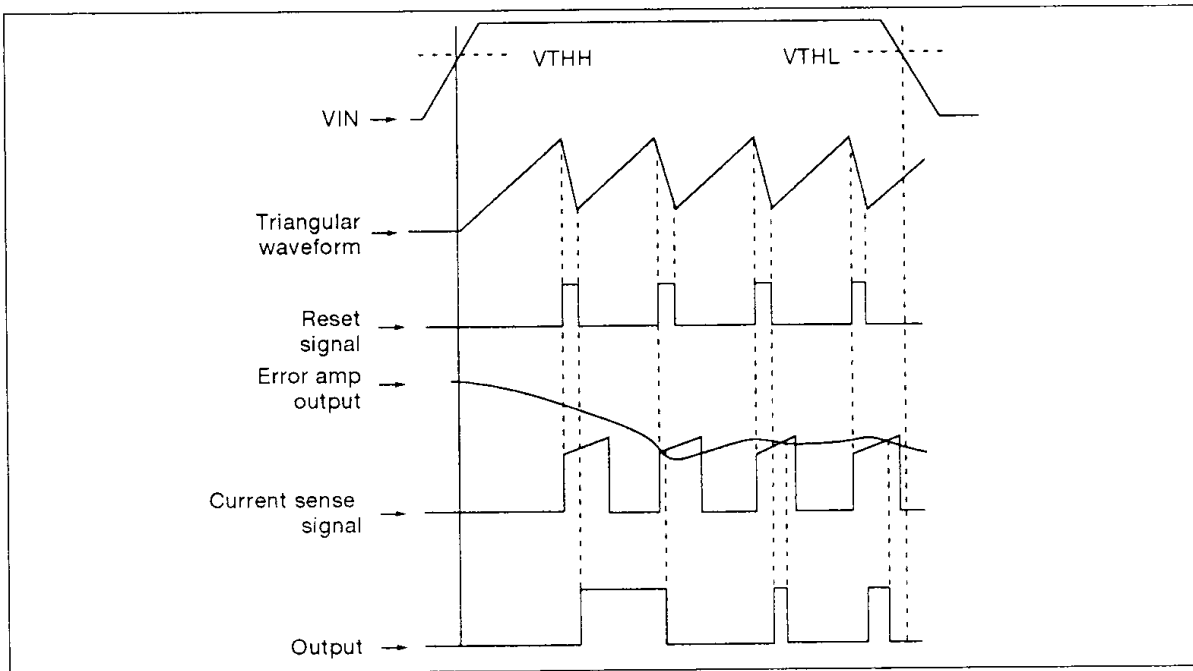
Section	Item	Symbol	Test Condition	min.	typ.	max.	Unit	Note
Reference Section	Output Voltage	Vref	Io = 1mA	4.85	5.00	5.15	V	
	Line Regulation	Line	VIN = 12 to 40V	—	6	20	mV	
	Load Regulation	Load	Io = 1 to 20mA	—	6	25	mV	
	Temperature Stability	VRTC	No load	—	0.2	—	%	
	Output Noise Voltage	VN	10Hz ≤ f ≤ 10KHz	—	50	—	μV	
	Short Circuit Current	Ios		30	100	180	mA	
Triangular Waveform Oscillation Section	Initial Accuracy	fdev		47	52	57	KHz	
	Voltage Stability	fr	12V < VIN < 40V	—	0.2	1	%	
	Temperature Range	Δf	-20°C ≤ Ta ≤ 85°C	—	5	—	%	
	Amplitude	Vosc	④ pin (⑦ pin) peak to peak	—	1.7	—	V	
Error Amp Section	Input Voltage	VEth	V① = 2.5V	2.42	2.50	2.58	V	
	Input Bias Current	IB1		—	0.3	2	μA	
	Open-Loop Voltage Gain	AVD	2V ≤ Vo ≤ 4V	65	90	—	dB	
	Unity Gain Bandwidth	Bw		0.7	1.0	—	MHz	
	Power Supply Rejection Ratio	PSRR	12V ≤ Vcc ≤ 40V	60	70	—	dB	
	Output Sink Current	Isink	V② (V③) = 2.7V, V① = 1.1V	2	6	—	mA	1
	Output Source Current	Isource	V② (V③) = 2.3V, V① = 5V	500	800	—	μA	1
	VOUT High	VOH	V② (V③) = 2.3V, RL = 15KΩ to ground	5	6	—	V	1
	VOUT Low	VOL	V② (V③) = 2.7V, RL = 15KΩ to Vref	—	0.7	1.1	V	1
	Comparator Section	Gain			2.85	3	3.15	V/V
Input Threshold Voltage		Vith		0.9	1.0	1.1	V	
Input Bias Current		IB2		—	2	10	μA	
Delay to Output		tr1		—	150	300	ns	

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

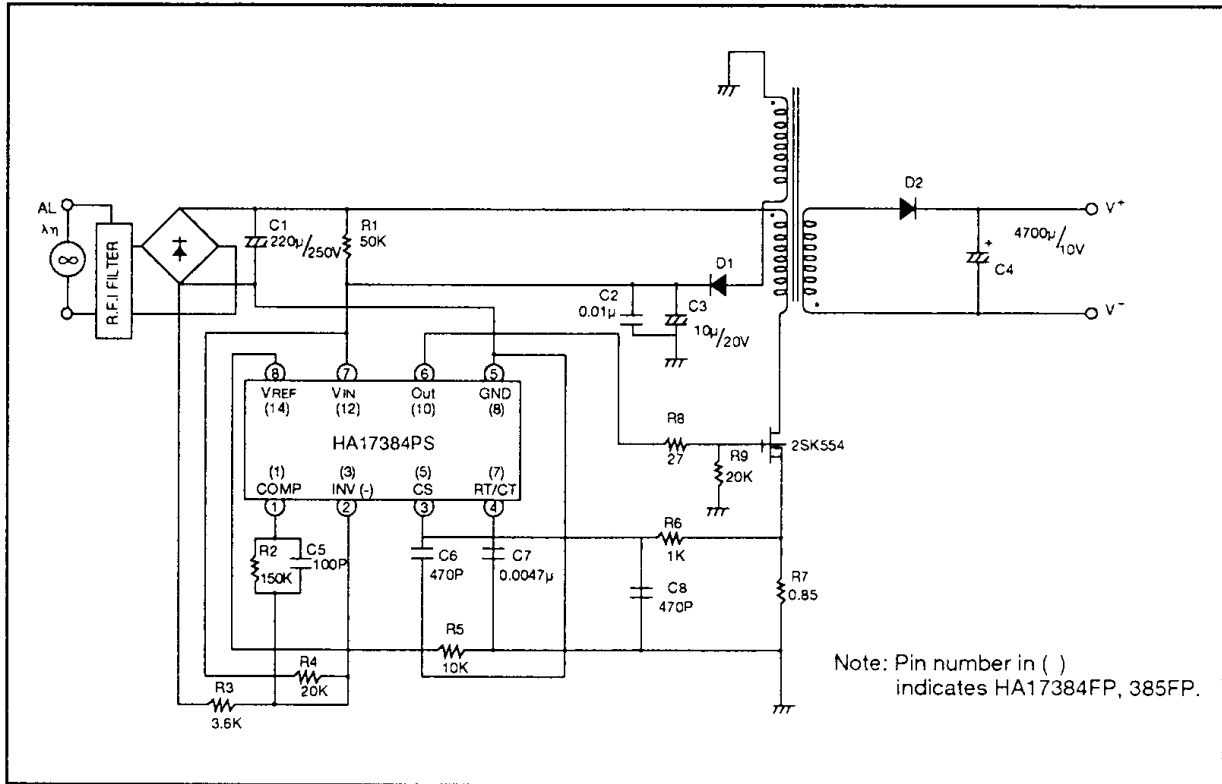
Section	Item	Symbol	Test Condition	min.	typ.	max.	Unit	Note
Output Section	Output High Level	VOH	$I_{sink}20mA$	13	13.5	—	V	
	Output High Level	VOH	$I_{sink}200mA$	12	13.5	—	V	
	Output Low Level	VOL	$I_{source}20mA$	—	0.1	0.4	V	
	Output Low Level	VOL	$I_{source}200mA$	—	1.5	2.2	V	
	Rise Time	$t_r$	$C_L = 1nF$	—	50	150	ns	
	Fall Time	$t_f$	$C_L = 1nF$	—	50	150	ns	
	Output Leak Current	ILO	$V_{CC} = 14V, V_{(6)} = 0V, V_{(10)} = 0V, UVL \text{ active}$	—	0.01	10	$\mu A$	1
	High Level Threshold	VTHH		14.5	16	17.5	V	
Low Level Threshold	VTHL		8.5	10	11.5	V		
Total Current Section	Standby Current	ICS		—	250	500	$\mu A$	
	Active Current	ICL	$V_{(2)} (V_{(3)}) = 0V, V_{(3)} (V_{(5)}) = 0V$	—	10	15	mA	1

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

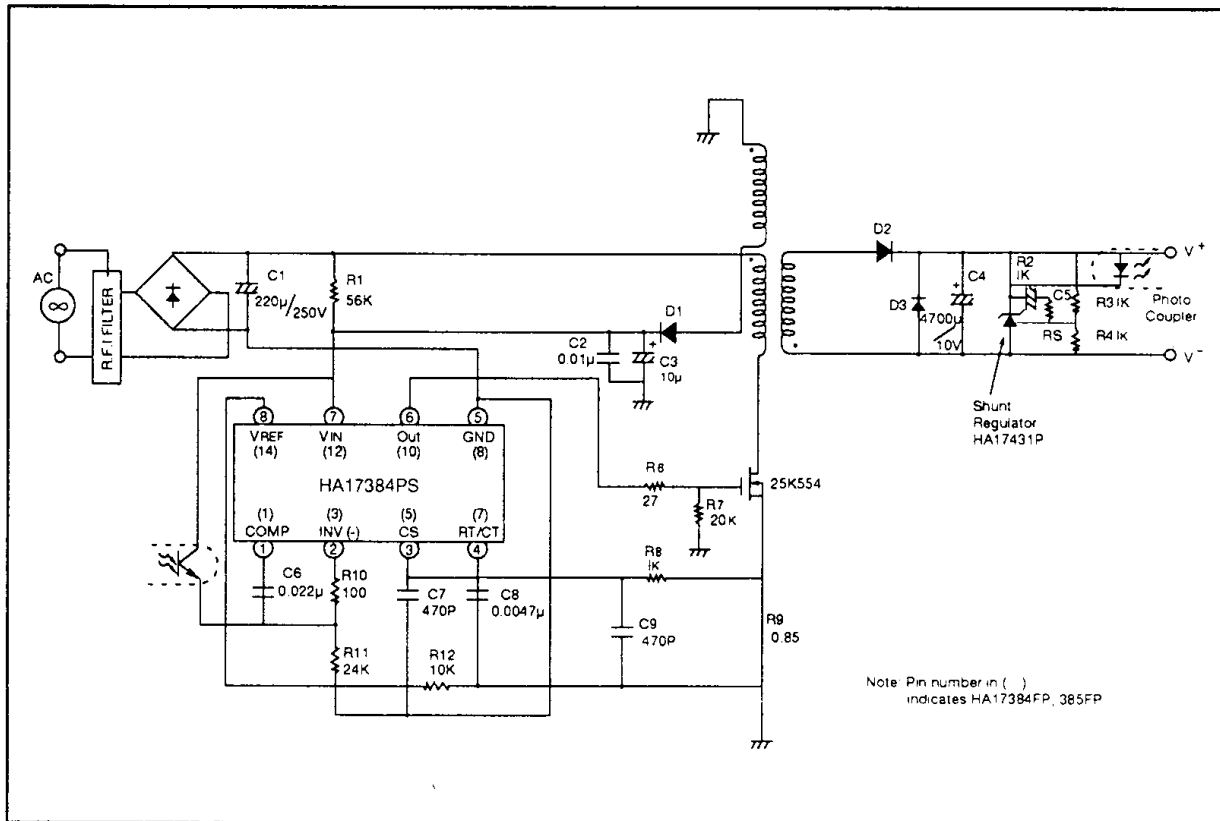
Waveform Timing



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System Configuration (Primary Current Sense Type)



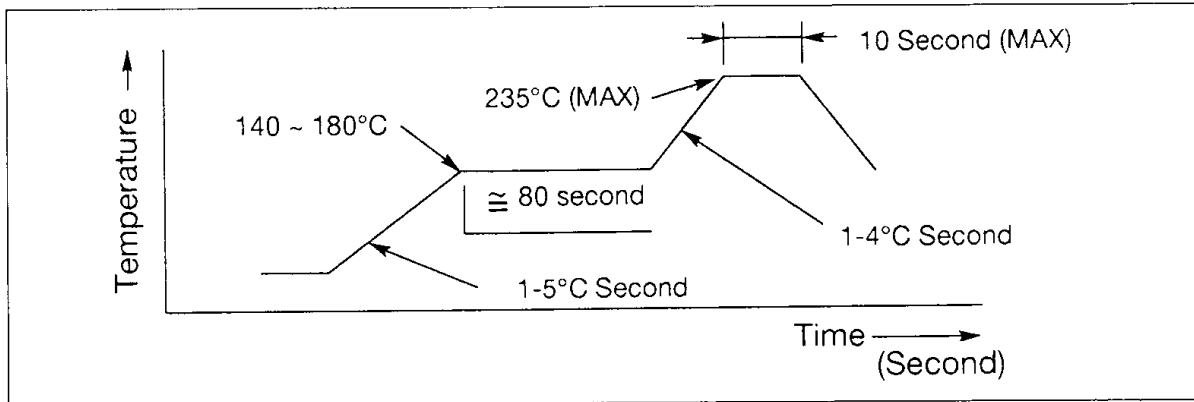
System Configuration (Secondary Current Sense Type)



**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**