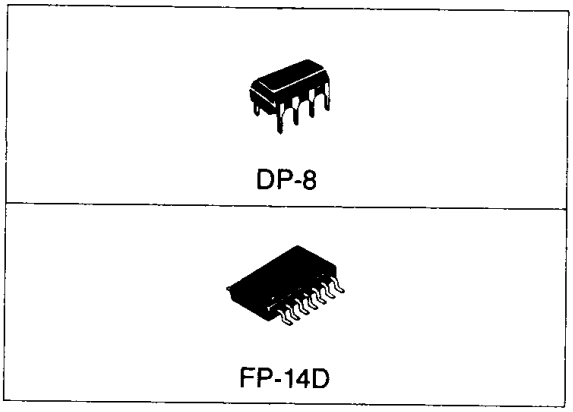
HA17384PS/FP, HA17385PS/FP — Preliminary

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 μA (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:
  tr = 50nsec (typ.) (at 15V swing)
  tf = 50nsec (typ.) (at 15V swing)
- Low power dissipation:
  500μA 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

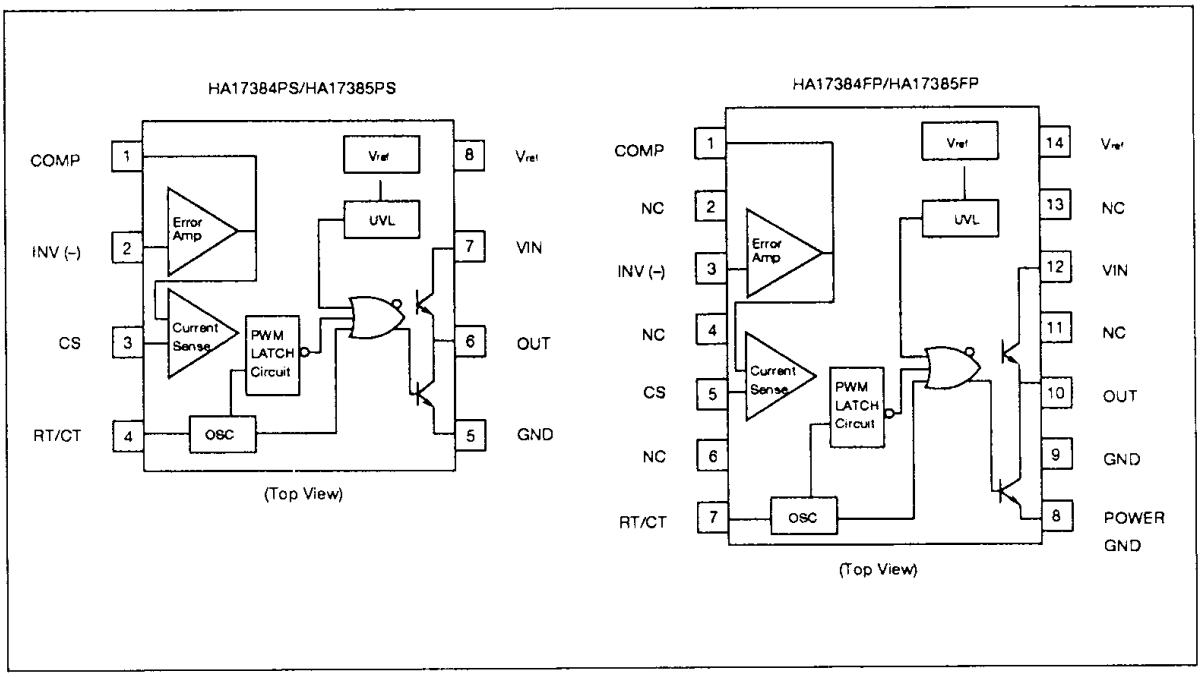
Ordering Information

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

Pin Functions

Symbol	Pin No. 384PS/385PS	Pin No. 384FP/385FP	Functions
COMP	1	1	Error amp. compensation
INV (–)	2	3	Error amp. input (–)
CS	3	5	Current sense
RT/CT	4	7	Timing registor, 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 (T_a = 25°C)

Item		Symbol	Rating HA384PS/385PS	Rating HA384FP/385FP	Unit
Power Supply Voltage		V_{IN}	+40	+40	V
Collector Current	DC	I_{odc}	push pull 0.3	push pull 0.3	A
	Peak	I_{opeak}	push pull 1.5***	push pull 1.5***	A
Error Input Voltage		V_E	–0.3 ~ +6.3	–0.3 ~ +6.3	V
Comparator Input Voltage		V_C	–0.3 ~ +6.3	–0.3 ~ +6.3	V
Error Amp Output Current		I_E	10	10	mA
Power Dissipation		P_T	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 $T_a \leq 25$°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 (max.) = $\theta_j - a \bullet P_C$ (max.) + T_a
($\theta_j - a$ 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.

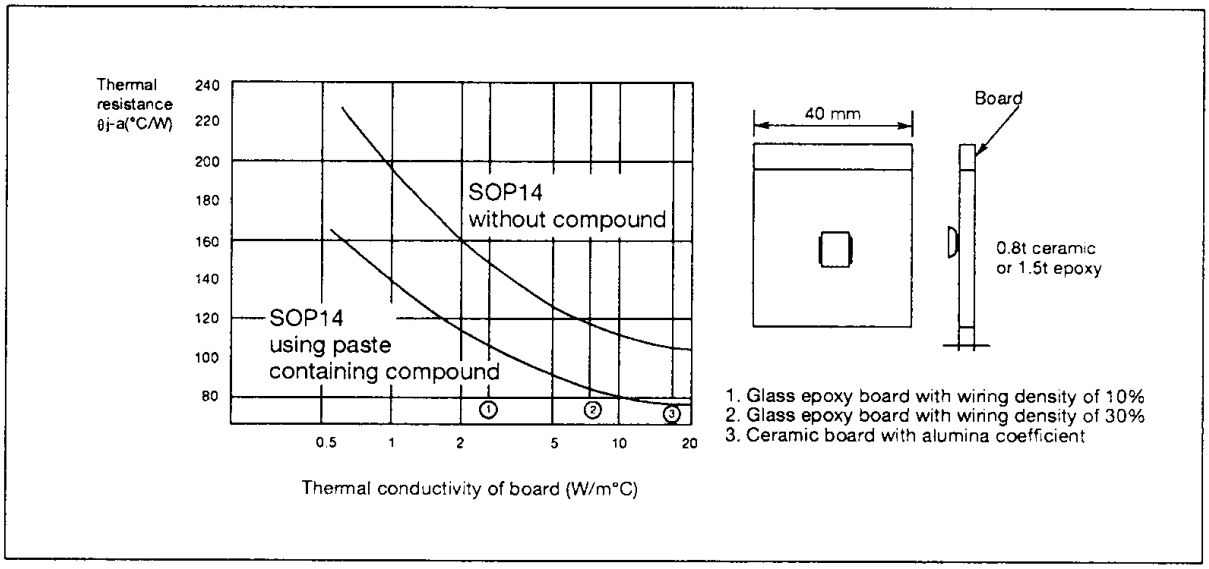


Figure 1. Thermal resistance of SOP

Electrical Characteristics (V_{IN} = 15V, Ta = 25°C, R_T = 10KΩ, C_T = 3300pF)

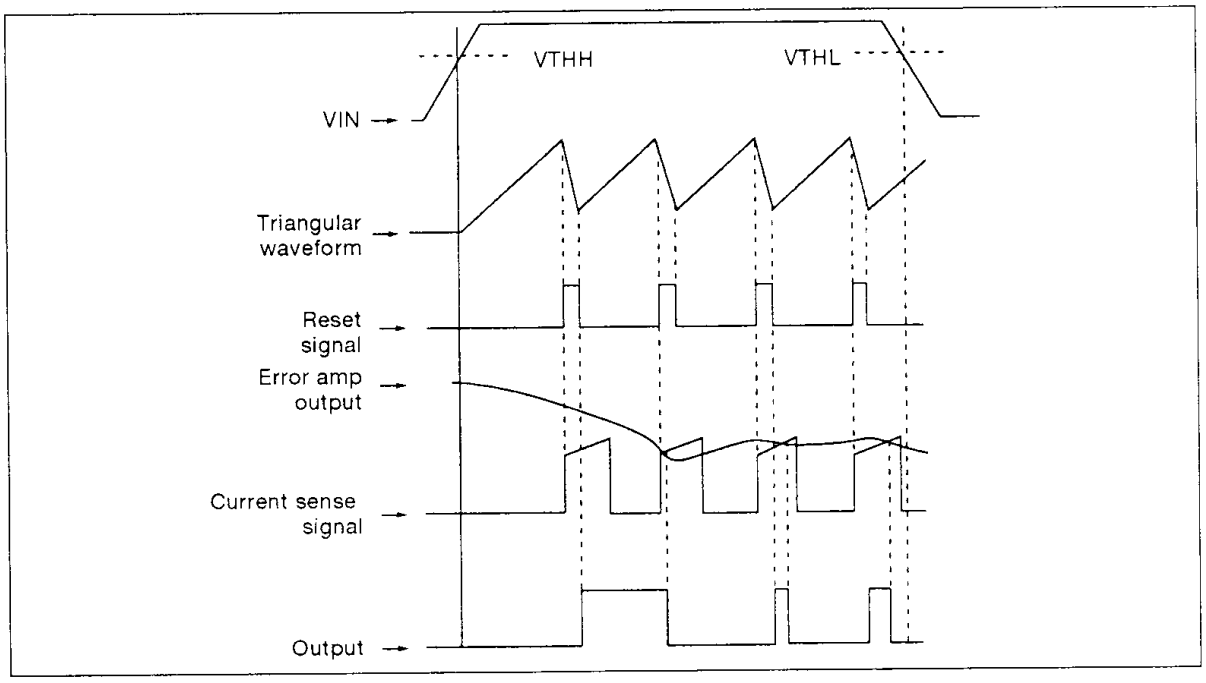
Section	Item	Symbol	Test Condition	min.	typ.	max.	Unit	Note
Reference Section	Output Voltage	V_{ref}	I_O = 1mA	4.85	5.00	5.15	V	
	Line Regulation	L_{ine}	V_{IN} = 12 to 40V	—	6	20	mV	
	Load Regulation	L_{oad}	I_O = 1 to 20mA	—	6	25	mV	
	Temperature Stability	V_{RTC}	No load	—	0.2	—	%	
	Output Noise Voltage	V_N	10Hz ≤ f ≤ 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_T	12V < V_{IN} < 40V	—	0.2	1	%	
	Temperature Range	△f	-20°C ≤ Ta ≤ 85°C	—	5	—	%	
	Amplitude	V_{osc}	④ pin (⑦ pin) peak to peak	—	1.7	—	V	
Error Amp Section	Input Voltage	V_{Eth}	V① = 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 ≤ V_O ≤ 4V	65	90	—	dB	
	Unity Gain Bandwidth	Bw		0.7	1.0	—	MHz	
	Power Supply Rejection Ratio	P_{SRR}	12V ≤ V_{CC} ≤ 40V	60	70	—	dB	
	Output Sink Current	I_{sink}	V② (V③) = 2.7V, V① = 1.1V	2	6	—	mA	1
	Output Source Current	I_{source}	V② (V③) = 2.3V, V① = 5V	500	800	—	μA	1
	V_{OUT} High	V_{OH}	V② (V③) = 2.3V, R_L = 15KΩ to ground	5	6	—	V	1
	V_{OUT} Low	V_{OL}	V② (V③) = 2.7V, R_L = 15KΩ to V_{ref}	—	0.7	1.1	V	1
Comparator Section	Gain			2.85	3	3.15	V/V	
	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	

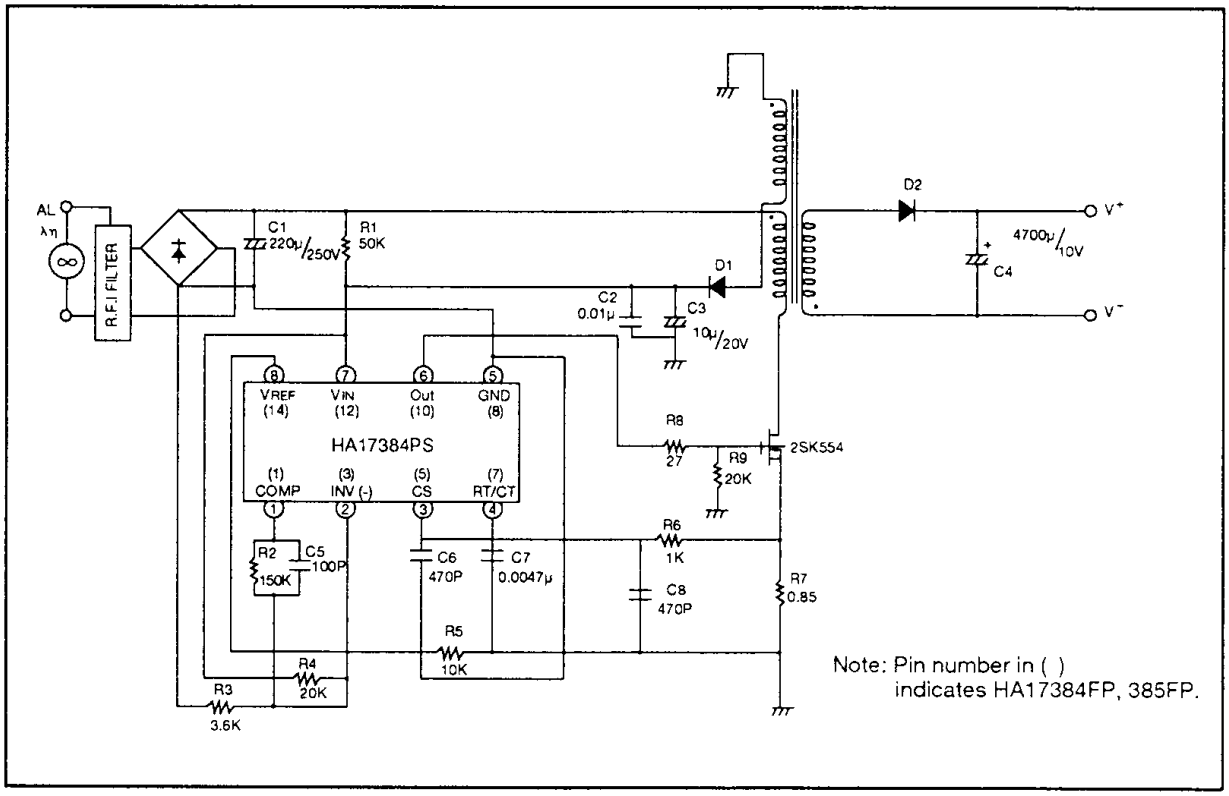
Electrical Characteristics (V_{IN} = 15V, Ta = 25°C, R_T = 10KΩ, C_T = 3300pF) (Cont'd.)

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, V⑥ (V_{10} = 0V, UVL active	—	0.01	10	μA	1
	High Level Threshold	V_{THH}		14.5	16	17.5	V	
	Low Level Threshold	V_{THL}		8.5	10	11.5	V	
Total Current Section	Standby Current	I_{CS}		—	250	500	μA	
	Active Current	I_{CL}	V② (V③) = 0V, V③ (V⑤) = 0V	—	10	15	mA	1

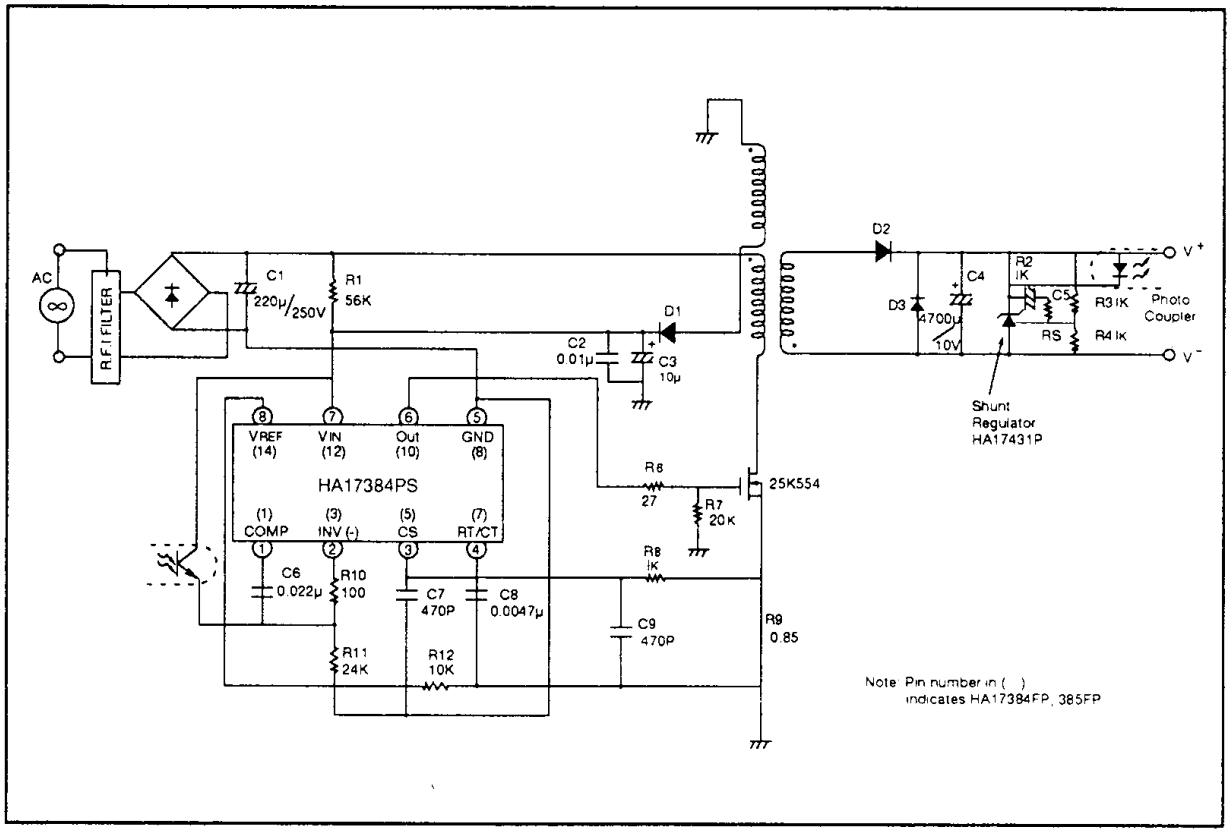
Note: 1. Pin number in ( ) indicates HA17384FP, HA17385FP.

Waveform Timing





System Configuration (Primary Current Sense Type)

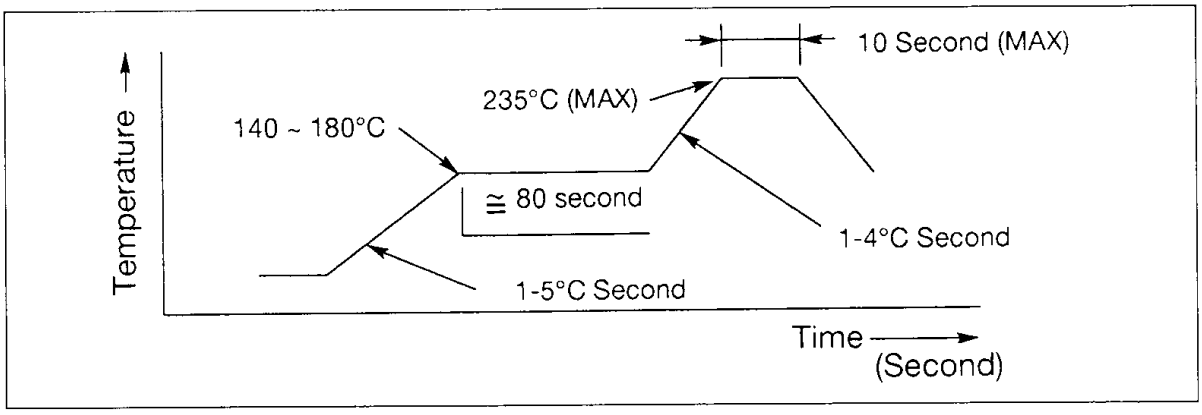


System Configuration (Secondary Current Sense Type)

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