

# 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.

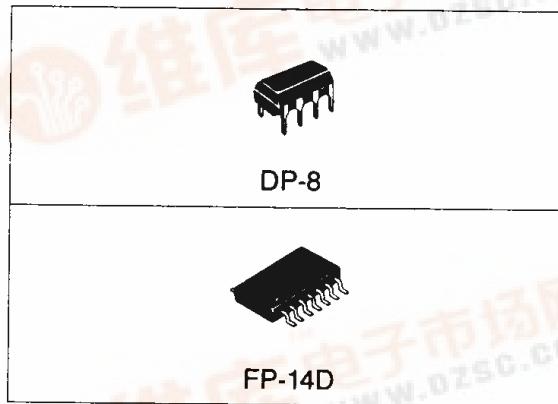
The two types of packages are DIP 8 and SOP 14 are provided for ICs.

### 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

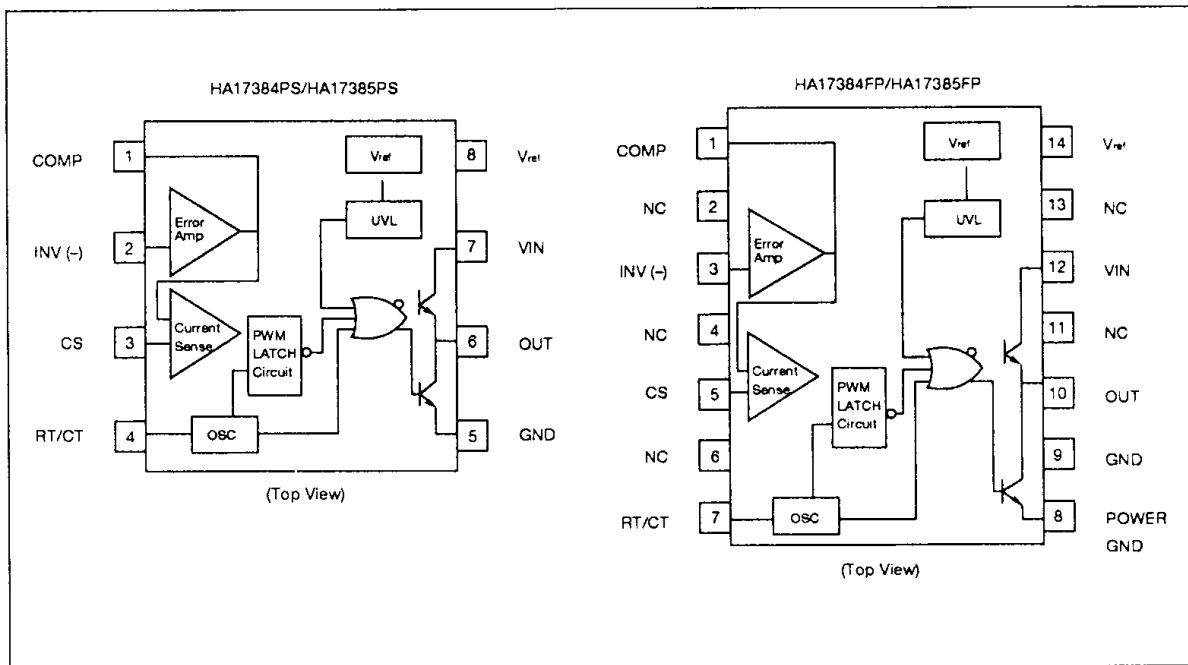
Type No.	Package
HA17384PS	DP-8
HA17384FP	FP-14D
HA17385PS	DP-8
HA17385FP	FP-14D

### 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 register, Timing capacitor
GND	5	8	Ground
OUT	6	10	Pulse output
V <sub>IN</sub>	7	12	Input voltage
V <sub>REF</sub>	8	14	Reference voltage (5V) output
P-GND	—	9	Power Ground

# HA17384PS/FP, HA17385PS/FP

## Block Diagram



## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Item	Symbol	Rating		Unit
		HA17384PS/385PS	HA17384FP/385FP	
Power Supply Voltage	VIN	+40	+40	V
Collector Current	DC	push pull 0.3	push pull 0.3	A
	Peak	lopeak	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  $T_a \leq 25^\circ\text{C}$ . If more than, 8.3mW/°C derating must be performed.

\*\* Allowable temperature of IC junction,  $T_j$  (max.), is as shown below.

$$T_j(\text{max.}) = \theta_j - a \cdot P_c(\text{max.}) + T_a$$

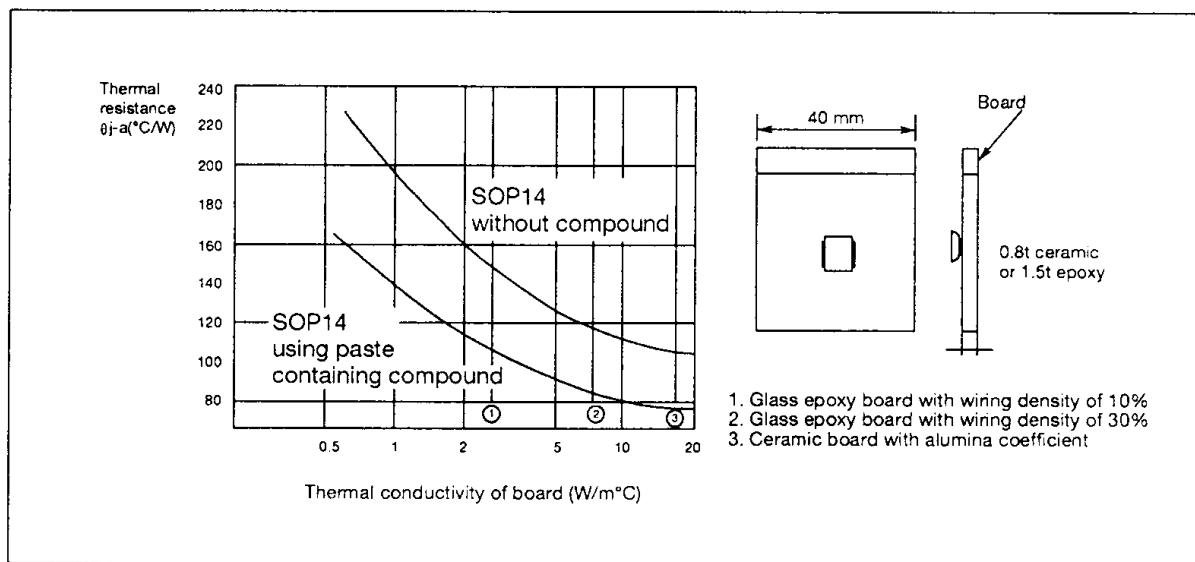
( $\theta_j$  - a is thermal resistance value during board mounting, and  $P_c$  (max.) maximum value of IC power dissipation.)

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 PT.

\*\*\* Value at a current flow period of 300nsec.

## HA17384PS/FP, HA17385PS/FP



**Figure 1. Thermal resistance of SOP**

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

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

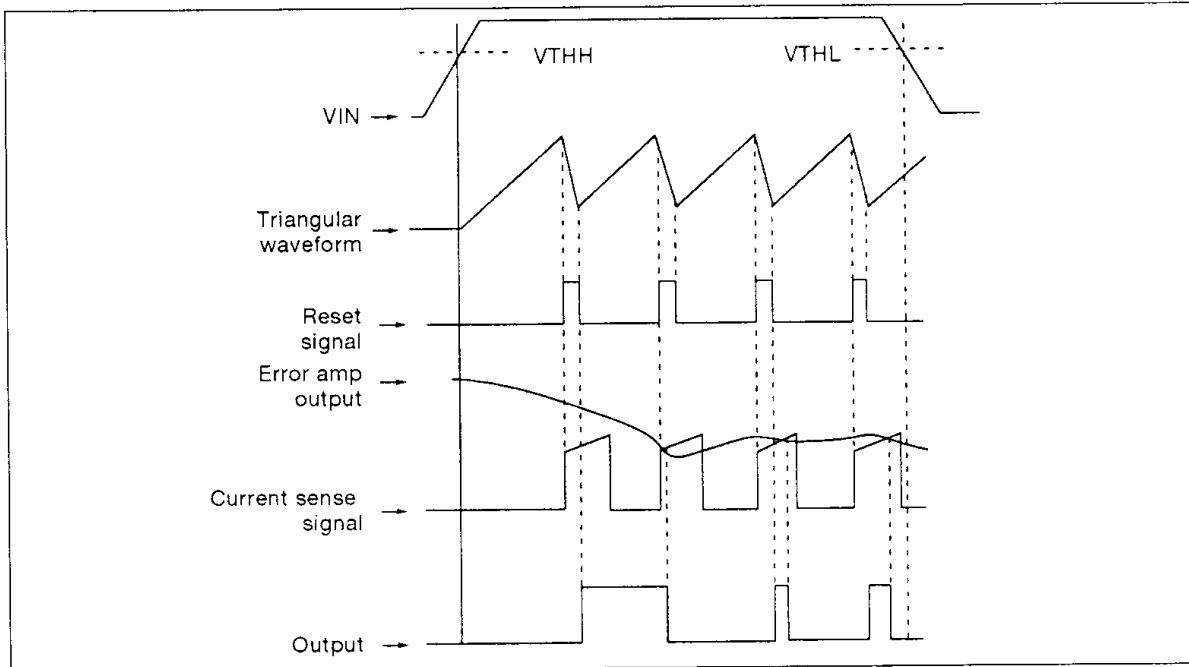
## HA17384PS/FP, HA17385PS/FP

### Electrical Characteristics (VIN = 15V, Ta = 25°C, RT = 10KΩ, CT = 3300pF) (Cont'd.)

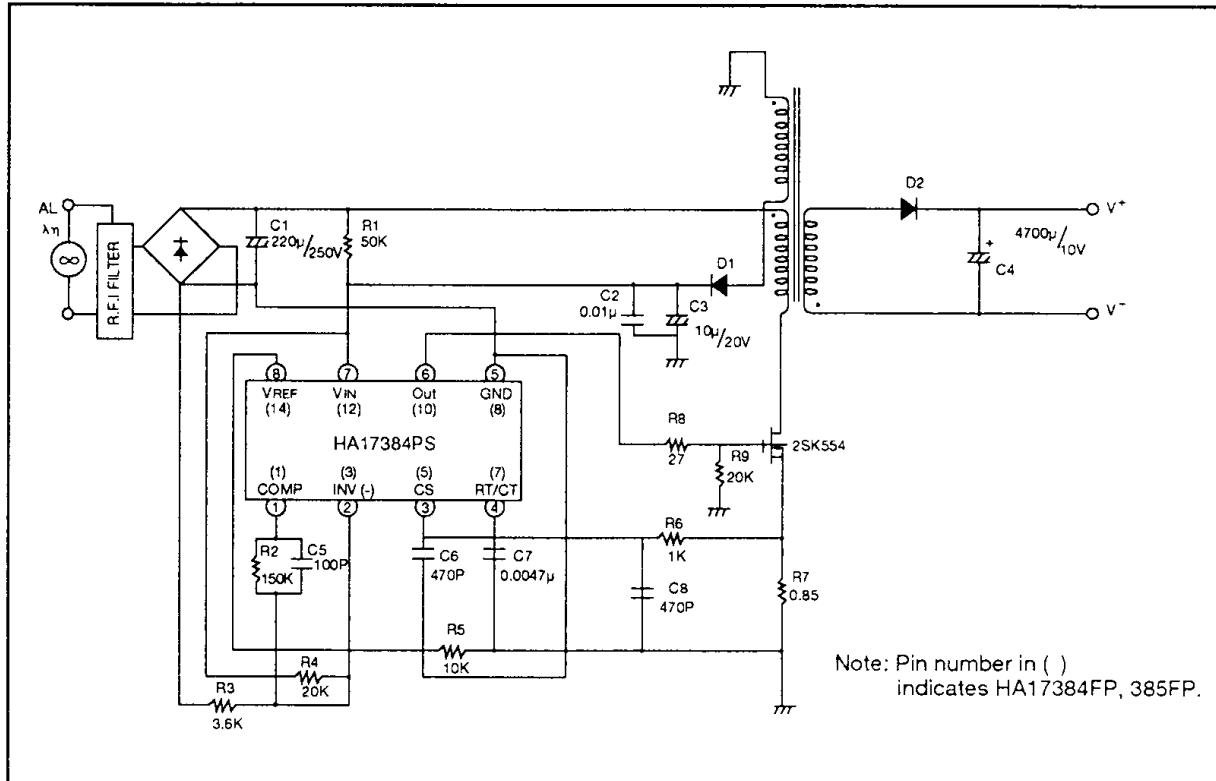
Section	Item	Symbol	Test Condition	min.	typ.	max.	Unit	Note
Output Section	Output High Level	VOH	Isink20mA	13	13.5	—	V	
	Output High Level	VOH	Isink200mA	12	13.5	—	V	
	Output Low Level	VOL	Isource20mA	—	0.1	0.4	V	
	Output Low Level	VOL	Isource200mA	—	1.5	2.2	V	
	Rise Time	tr	CL = 1nF	—	50	150	ns	
	Fall Time	tr	CL = 1nF	—	50	150	ns	
	Output Leak Current	ILO	VCC = 14V, V <sub>⑥</sub> (V <sub>10</sub> = 0V, UVL active)	—	0.01	10	μA	1
	High Level Threshold	VTHH		14.5	16	17.5	V	
Total Current Section	Low Level Threshold	VTHL		8.5	10	11.5	V	
	Standby Current	ICS		—	250	500	μA	
	Active Current	ICL	V <sub>②</sub> (V <sub>③</sub> ) = 0V, V <sub>③</sub> (V <sub>⑤</sub> ) = 0V	—	10	15	mA	1

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

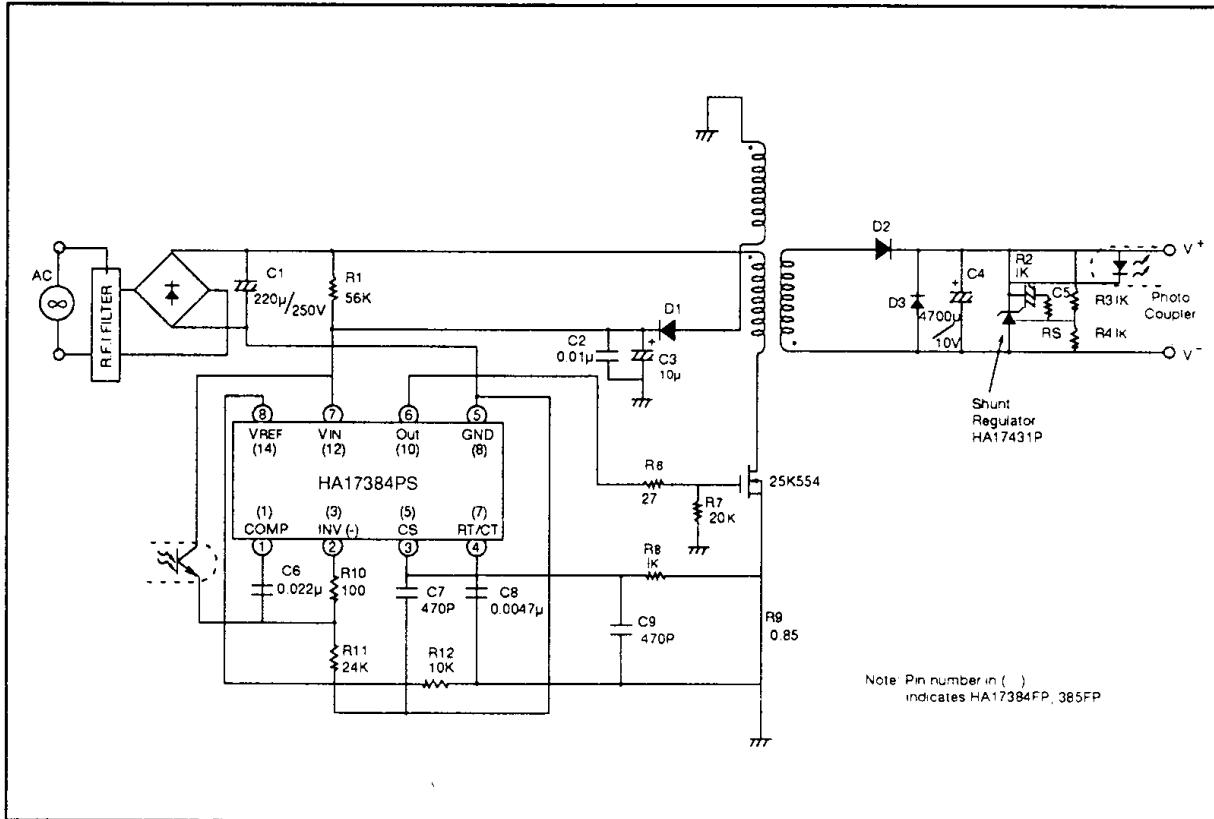
### Waveform Timing



## HA17384PS/FP, HA17385PS/FP



System Configuration (Primary Current Sense Type)



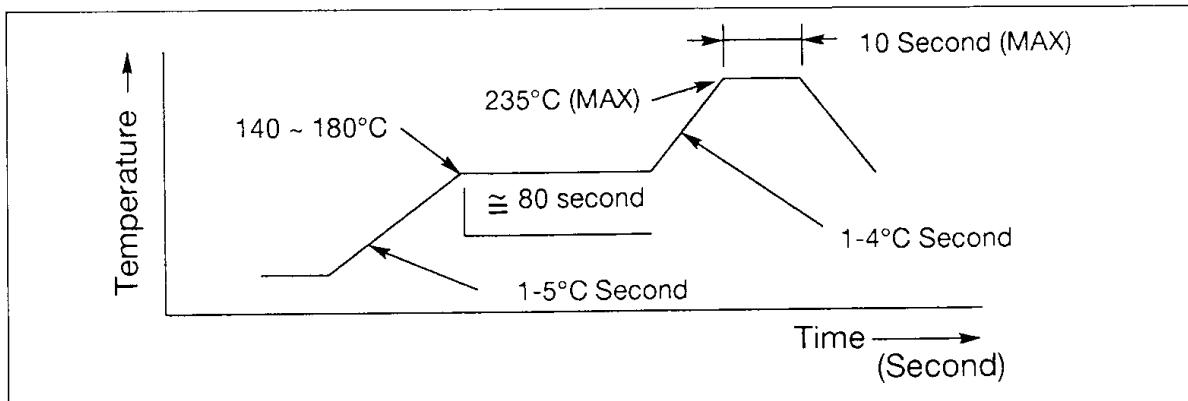
System Configuration (Secondary Current Sense Type)



**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**