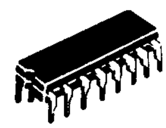
HA17451P/FP

PWM Control Dual Switching Regulator IC

Description

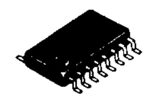
The HA17451 is a PWM control IC containing the same two basic circuits for switching regulator.
The two basic circuit is able to realize the perfect synchronous operation to common oscillator frequency.
So this IC has two output switches and is designed to be incorporated in Step-Up and Step-Down and Voltage Inverting applications.
The operation range versus input is wide, 3 ~ 40V.
So the HA17451 is suitable for DC-to-DC converters, using the batteries.

HA17451P



(DP-16)

HA17451FP



(FP-16D)

Features

- Internal low drop out voltage regulator circuit (V_{out} = 2.5V, V_{drop} = 0.2V typ.)
- Wide range of operating supply voltage 3V ~ 40V
- Large maximum output current.....50mA (max.)
- Internal under voltage lockout protection circuit
  High threshold voltage ....2.8V (typ.)
  Low threshold voltage ....2.6V (typ.)
- Internal timer latch short protection circuit
- Low power dissipation ....1.5mA (typ.)
- Wide range of operating oscillation frequency f_{osc} = 1KHz ~ 500KHz
- Wide dead band range (D.B. duty 0 ~ 100%)
- Small surface mount package (SOP: small outline package) for high density PCB

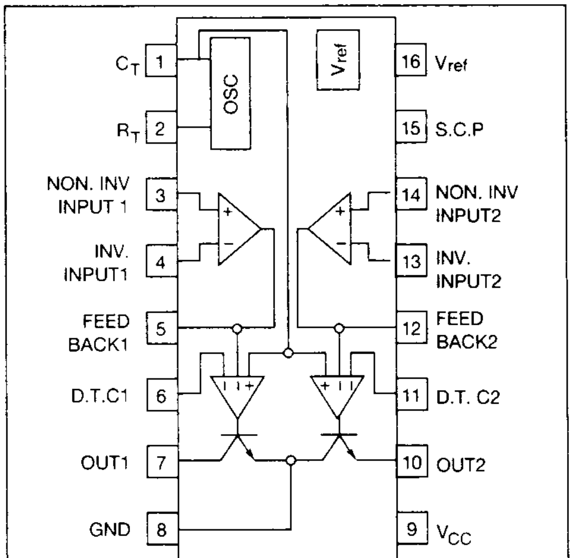
Functions

- Low drop out 2.5V reference voltage circuit
- Under voltage lockout protection circuit
- Timer latch short protection circuit
- Triangular waveform oscillation circuit
- Dead time control circuit
- Error amplifier circuit
- Output driver circuit
- PWM comparator circuit

Ordering Information

Type No.	Package
HA17451P	DP-16
HA17451FP	FP-16D

Pin Arrangement



(Top View)

Pin Functions

Pin No.	Symbols	Functions
1	CT	Timing Capacitor
2	RT	Timing Registor
3, 14	Non. Inv. Input	Non invert input of error amp.
4, 13	Inv. Input	Invert input of error amp.
5, 12	Feed Back	Output of error amp.
6, 11	D.T.C.	Dead time control
7, 10	OUT	Output
8	GND	Ground
9	Vcc	Input voltage
15	S.C.P.	Short circuit protection
16	Vref	Reference voltage output

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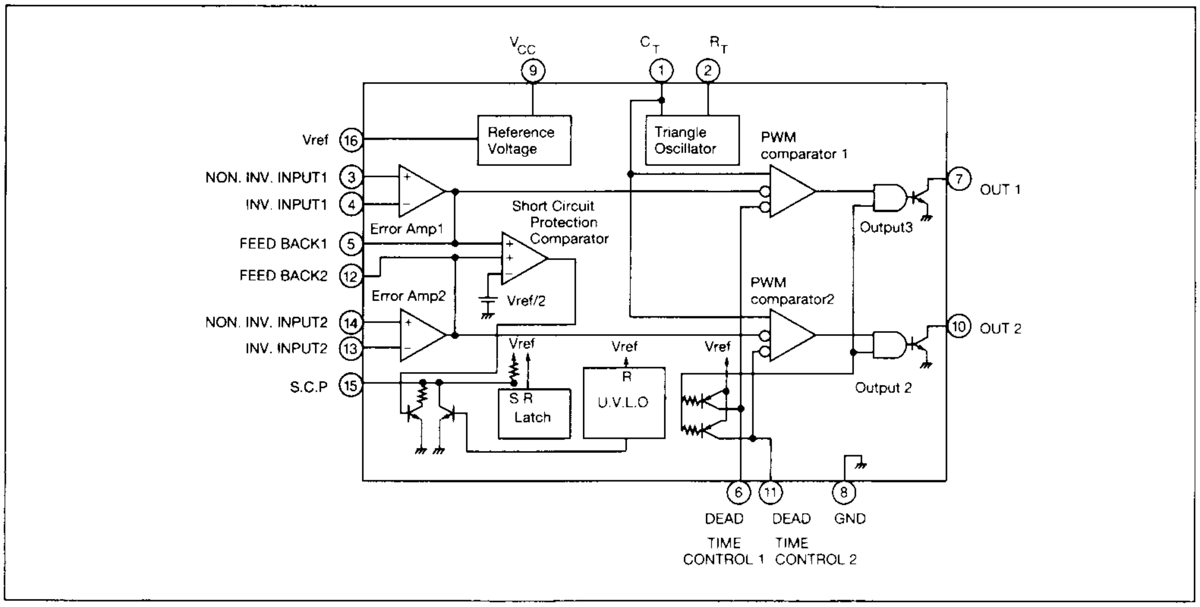
Block Diagram



Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating	Unit	Note
Power Supply Voltage	VCC	40	V	
Error Amp. Input Voltage	VI	20	V	
Collector Output Voltage	VO	40	V	
Collector Output Current	IO	50	mA	
Power Dissipation	PT	680	mW	1
Operation Temperature Range	Topr	−20 ~ +85	°C	
Storage Temperature Range	Tstg	−55 ~ +125	°C	

T_j (max.) = θ_{j-a} • P_C (max.) + T_a
(θ_{j-a} is thermal resistance value during 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 ratio shown below.
Be careful that the value of P_C (max.) does not exceed that of PT.

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.

Note: 1. In HA17451P a value of Ta < 45°C is permissible. If more than 8.3mW/°C derating must be performed. In HA17451FP allowable junction temperature of IC, T_j (max.), is shown below.

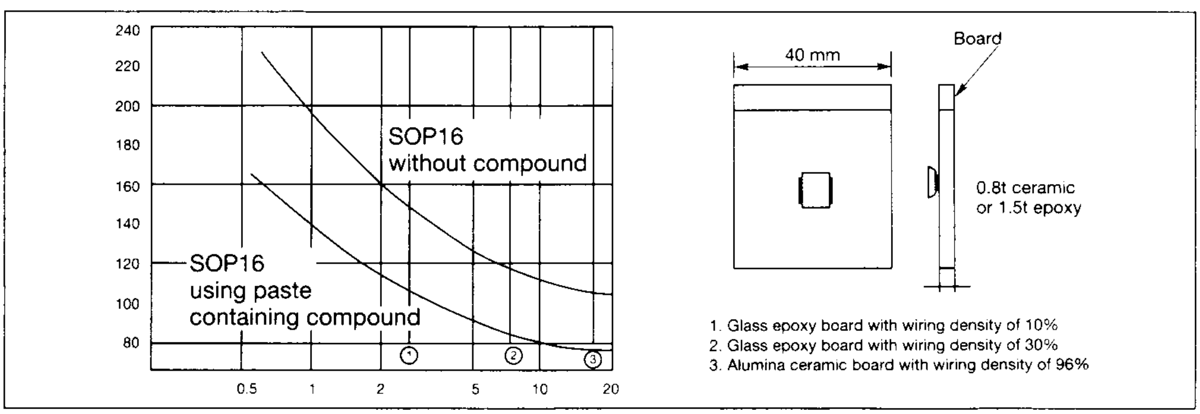


Figure 1. Thermal resistance of SOP

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Electrical Characteristics (T_a = 25°C, V_{CC} = 6V, f_{osc} = 200KHz)

Item	Symbol	Test Condition	Spec min.	Spec typ.	Spec max.	Unit
(1) Reference Section						
Output Voltage	V_{ref}	I_O = 1mA	2.40	2.50	2.60	V
Voltage Drop	V_{drop}	I_O = 1mA	—	0.2	0.5	V
Line Regulation	Line	V_{CC} = 3.0 ~ 40V	—	2	12.5	mV
Load Regulation	Load	I_O = 0.1 ~ 1mA	—	1	7.5	mV
Temperature Stability	R_{TC1}	T_a = −20 ~ 25°C	—	−0.1	—	%
	R_{TC2}	T_a = 25 ~ 85°C	—	−0.1	—	%
Short Circuit Current	I_{OS}	V_{ref} = 0V	3	10	30	mA
(2) Under Voltage Lockout Protection Section						
High Level Threshold	V_{th}	I_O = 0.1mA	—	2.8	—	V
Low Level Threshold	V_{tl}	I_O = 0.1mA	—	2.6	—	V
Hysterisis Width	V_{HYS}	I_O = 0.1mA	140	200	—	mV
Reset Voltage	V_R	I_O = 0.1mA	1.5	1.9	—	V
(3) Protection Section						
Input Threshold	V_{TPC}		0.65	0.7	0.75	V
Input Standby Voltage	V_{STBY}	No Pull Up	140	185	230	mV
Input Latch Voltage	V_I	No Pull Up	—	60	120	mV
Input Source Current	I_{bpc}		10	15	20	μA
Comparator Threshold Voltage	V_{tc}	5 pin, 12 pin	—	1.18	—	V
(4) Oscillator Section						
Frequency	f_{osc}	C_T = 330pF, R_T = 10K Ω	—	200	—	KHz
Initial Accuracy	f_{dev}		—	10	—	%
Voltage Stability	f_{dv}		—	1	—	%
Temperature Stability	f_{dT1}	T_a = −20 ~ 25°C	—	−0.4	—	%
	f_{dT2}	T_a = 25 ~ 85°C	—	−0.2	—	%
(5) Dead Time Control Section						
Input Bias Current	I_{bdt}		—	—	1	μA
Latch Mode Source Current	I_{dt}		80	145	—	μA
Latch Input Voltage	V_{dt}		2.3	—	—	V
Input Threshold Voltage	V_{t0}	f_{osc} = 10KHz Duty Cycle = 0%	—	2.05	2.25	V
Input Threshold Voltage	V_{t100}	f_{osc} = 10KHz Duty Cycle = 100%	1.20	1.45	—	V
(6) Error Amp Section						
Input Offset Voltage	V_{IO}	V_O (5, 12 Pin) = 1.25V	−6	—	6	mV
Input Offset Current	I_{IO}	V_O (5, 12 Pin) = 1.25V	−100	—	100	nA
Input Bias Current	I_B	V_O (5, 12 Pin) = 1.25V	—	160	500	nA
Common Mode Input Voltage Range	V_{ICR}	V_{CC} = 3 ~ 40V	1.0	—	1.45	V
Open Loop Gain	A_V	R_{NF} 200KΩ	70	80	—	dB
Band Width	G_B		—	1.5	—	MHz
Common Mode Rejection Ratio	C_{MRR}		60	80	—	dB
Maximum Output Voltage	V_{OM+}		V_{ref} −0.1	—	—	V
	V_{OM-}		—	—	1.0	V
Output Sink Current	I_{OM+}	V_O = 1.25V	0.5	1.6	—	mA
Output Source Current	I_{OM-}	V_O = 1.25V	−45	−70	—	μA

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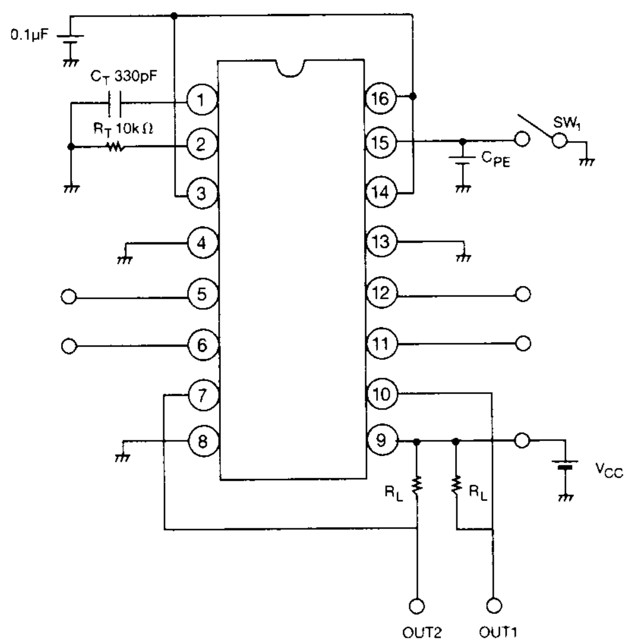
Electrical Characteristics (Ta = 25°C, VCC = 6V, fosc = 200KHz) (Cont'd.)

Item	Symbol	Test Condition	Spec min.	Spec typ.	Spec max.	Unit
(7) Output Section						
Collector Off-State Current (1)	$I_{Leak(1)}$	V_O = 40V	—	—	10	μA
Collector Off-State Current (2)	$I_{Leak(2)}$	V_O = 40V V_{CC} = Open	—	—	10	μA
Saturation Voltage	V_{sat}	I_O = 10mA	—	1.2	2	V
Short Current	I_{OS}	V_O = 6V	—	120	—	mA
(8) PWM Comparator Section						
Input Threshold Voltage	V_{t0}	fosc = 10KHz Duty Cycle = 0%	—	2.05	2.25	V
Input Threshold Voltage	V_{t100}	fosc = 10KHz Duty Cycle = 100%	1.20	1.45	—	V
Input Sink Current	I_{sink}	V_O (5, 12 Pin) = 1.25V	0.5	1.6	—	mA
Input Source Current	I_{source}	V_O (5, 12 Pin) = 1.25V	-45	-70	—	μA
(9) Total Current Section						
Standby Current	I_{CCS}	Output Off-State	—	1.5	2.0	mA
Average Supply Current	I_{CCA}	R_T = 10KΩ	—	1.9	2.6	mA

Measurement Circuit



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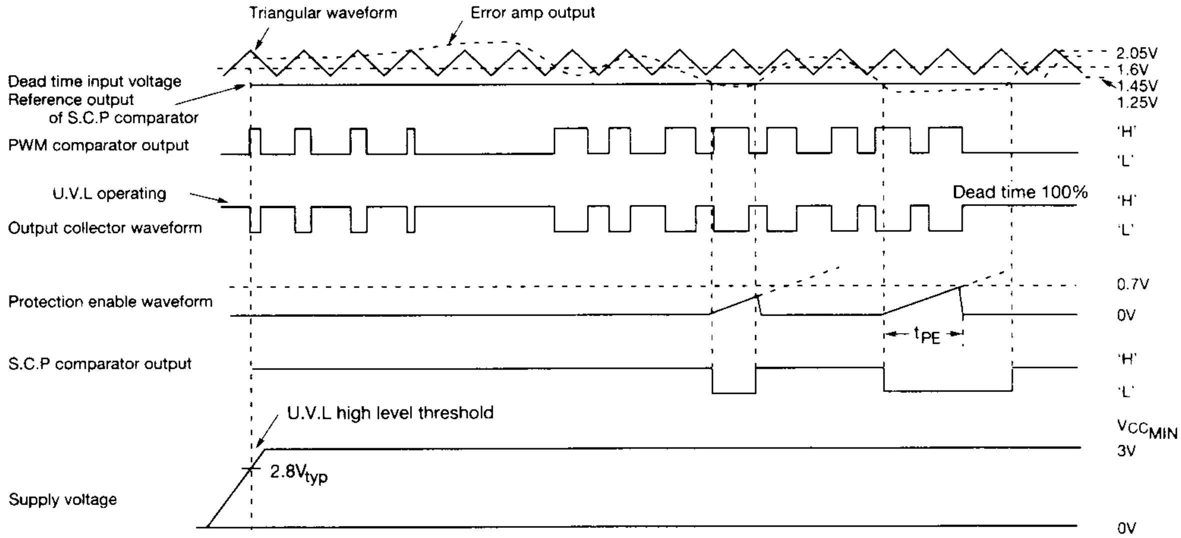
Waveform Timing



Protection Enable Time, $t_{PE} = 0.051 \times 10^6 \cdot C_{PE}$ (Sec)

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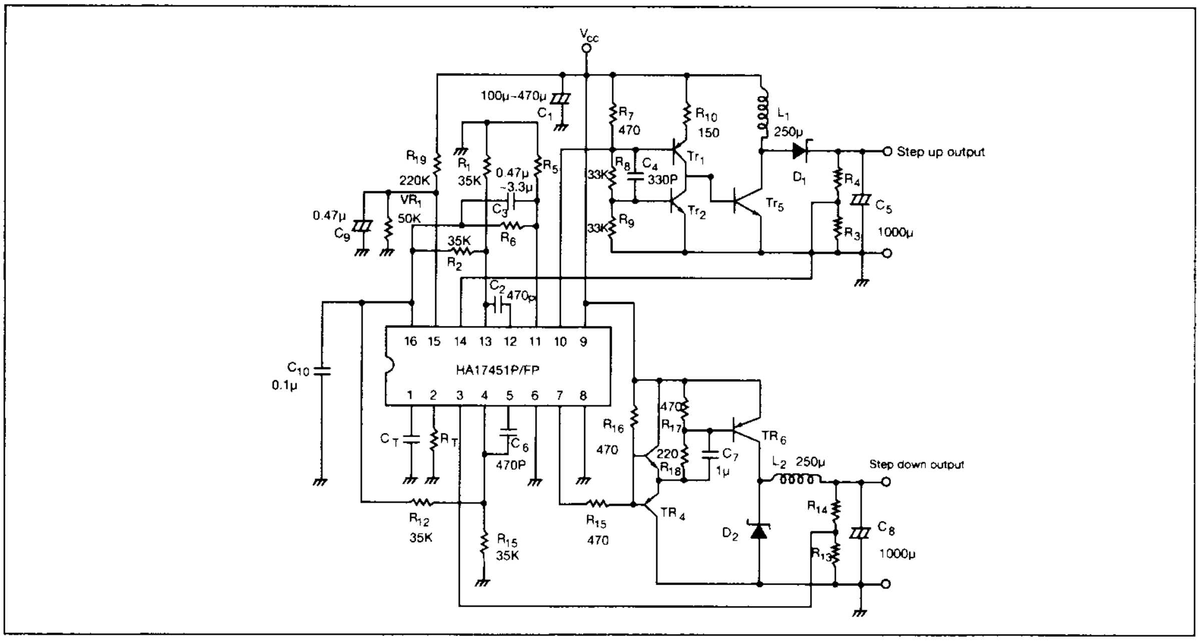
System Configuration

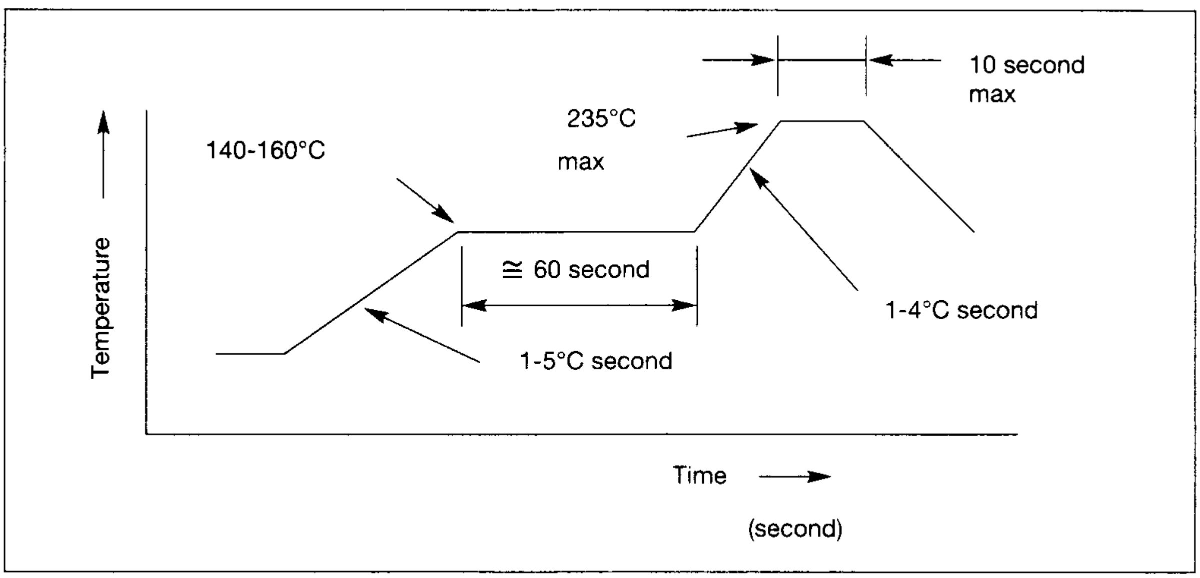


High Frequency Dual Switching Regulator System

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 mounted substrates and IC lead may cause a failure like solder peeling or solder wet, and electrical characterictics 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

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