



# TS1451

## Dual Channel PWM Controller

SOP-16



DIP-16



**Supply Voltage Range 3.6 V to 40V**  
**Output Driving Current 20mA**  
**Oscillator Frequency up to 500KHz**

### General Description

The TS1451 integrates dual channel PWM control circuit into a single chip, mainly designs for power supply regulator. All the functions included an on-chip 2.5V reference output, two error amplifiers, and adjustable oscillator, two dead-time comparators, under voltage lock out, short circuit protection, and dual common-emitter output transistor circuit.

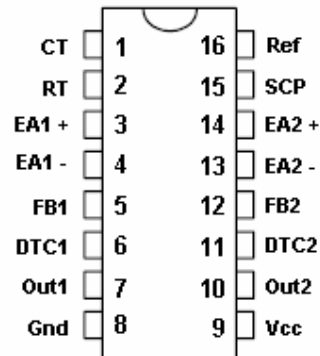
Recommend the output CE transistors as pre-driver for driving extremely. the dead time control can provide from 0% to 100%. Switching frequency can be adjustable by trimming RT and CT. During low Vcc situation, the under voltage lock out makes sure that the output are off until the internal circuit is operational normally.

The TS1451 is offered in SOP-16 and DIP-16 package.

### Features

- ◇ Dual PWM Power Control Circuitry
- ◇ Operating Voltage Can be up to 50V
- ◇ Adjustable Dead Time Control (DTC)
- ◇ Under Voltage Lock Out protection (UVLO)
- ◇ Short Circuit Protection (SCP)
- ◇ Variable Oscillator Frequency up to 500KHz
- ◇ 2.5V Voltage Reference Output

### Pin Assignments



### Applications

- ◇ Backlight Inverter
- ◇ DC to DC Converters in Computers

### Pin Descriptions

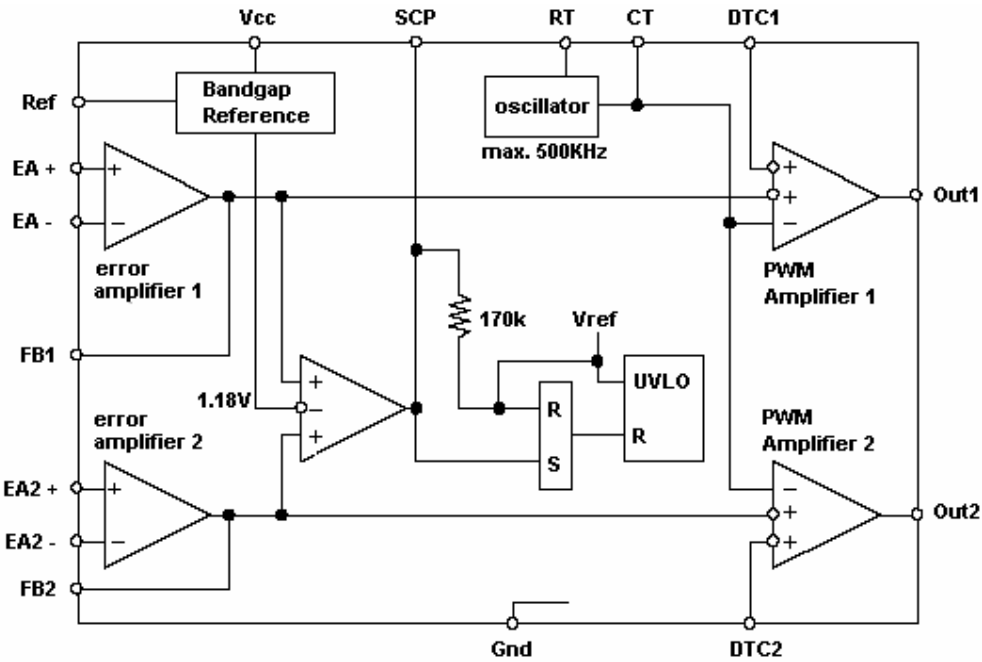
Name	Descriptions
CT	Timing Capacitor
RT	Timing Resistor
EA+	Error Amplifier Input (+)
EA-	Error Amplifier Input (-)
FB	Feedback Loop Compensation
DTC	Dead Time Control
Out	Pre-Driver Output
Gnd	Ground
Vcc	Supply Voltage
SCP	Short Circuit Protection
Ref	Voltage Reference

### Ordering Information

Part No.	Operating Temp.	Package
TS1451CD	0 ~ +70 °C	DIP-16
TS1451CS		SOP-16



## Function Block Diagram



## Absolute Maximum Rating

Rating	Symbol	Value	Unit
Power Supply Voltage	Vcc	40	V
Collector Output Voltage	Vo	40	V
Collector Output Current	Io	21	mA
Amplifier Input Voltage Range	Vin	20	V
Operating Junction Temperature	Tj	- 20 ~ +85	°C
Storage Temperature Range	Tstg	-65 ~ +150	°C
Lead Temperature 1.6mm from case for 10 sec.	Tled	260	°C

## Recommended Operating Conditions

Rating	Symbol	Min.	Max	Unit
Power Supply Voltage	Vcc	3.6	40	V
Collector Output Voltage	Vo	--	40	V
Collector Output Current (each transistor)	Io	--	20	mA
Amplifier Input Voltage	Vin	1.05	1.45	V
Current Into Feedback Terminal	I <sub>fb</sub>	--	45	uA
Feedback Resistor	R <sub>f</sub>	100	--	KΩ
Timing Resistor	R <sub>T</sub>	5.1	100	KΩ
Timing Capacitor	C <sub>T</sub>	150	15000	pF
Oscillator Frequency	F <sub>osc</sub>	1	500	KHz



**Electrical Characteristics** ( $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 6\text{V}$ ,  $f = 200\text{KHz}$ ; unless otherwise specified)

**REFERENCE SECTION**

Parameter	Test Conditions	Min	Typ	Max	Unit
Output voltage ( $V_{ref}$ )	$I_o = 1\text{mA}$	2.45	2.5	2.6	V
Line regulation	$V_{CC} = 3.6\text{V to } 40\text{V}$	--	2.0	12.5	mV
Load regulation	$I_o = 0.1\text{mA to } 1\text{mA}$	--	1.0	7.5	
Output voltage change with temp.	$\Delta T_a = \text{Min to Max}$	--	- 0.2	+/- 1	%
Short-circuit output current	$V_{ref} = 0$	3	10	30	mA

**UNDERVOLTAGE LOCKOUT SECTION**

Parameter	Test Conditions	Min	Typ	Max	Unit
Upper threshold voltage ( $V_{CC}$ )	$I_o(\text{ref}) = 0.1\text{mA}$	--	2.65	--	V
Lower threshold voltage ( $V_{CC}$ )		--	2.45	--	V
Hysteresis ( $V_{CC}$ )		80	200	--	mV

**SHORT-CIRCUIT PROTECTION CONTROL SECTION**

Parameter	Test Conditions	Min	Typ	Max	Unit
Input threshold voltage		0.65	0.7	0.75	V
Standby voltage	No pull up	140	185	--230	mV
Latched input voltage	No pull up	--	60	120	mV
Input (source) current	$V_{in} = 0.7\text{V}$	- 10	- 15	- 20	$\mu\text{A}$
Comparator threshold voltage (FB)		--	1.18	--	V

**OSCILLATOR SECTION**

Parameter	Test Conditions	Min	Typ	Max	Unit
Frequency	$C_T = 330\text{pF}$ , $R_T = 10\text{K}\Omega$	--	200	--	KHz
Standard deviation of frequency	$C_T = 330\text{pF}$ , $R_T = 10\text{K}\Omega$	--	10	--	%
Frequency change with voltage	$V_{CC} = 3.6\text{V to } 40\text{V}$	--	1	--	
Frequency change with temperature	$\Delta T_a = \text{Min to Max}$	--	--	+/- 2	

**DEAD-TIME CONTROL SECTION**

Parameter	Test Conditions	Min	Typ	Max	Unit
Input bias current		--	--	1	$\mu\text{A}$
Latch mode (source) current		- 80	- 145	--	
Latch input voltage	$I_o = 40\mu\text{A}$	2.3	--	--	V
Input threshold voltage at $f = 10\text{KHz}$	Zero duty cycle	--	2.05	2.25	
	Maximum duty cycle	1.2	1.45	--	

**OUTPUT SECTION**

Parameter	Test Conditions	Min	Typ	Max	Unit
Leakage current	$V_o = 40\text{V}$	--	--	10	$\mu\text{A}$
Output saturation voltage	$I_o = 10\text{mA}$	--	1.2	2	V
Short-circuit output current	$V_o = 6\text{V}$	--	90	--	mA



**Electrical Characteristics** (Continued)

**ERROR AMPLIFIER SECTION**

Parameter	Test Conditions	Min	Typ	Max	Unit
Input offset voltage	$V_{o(FB)} = 1.25V$	--	--	+/- 6	mV
Input offset current	$V_{o(FB)} = 1.25V$	--	--	+/- 100	nA
Input bias current	$V_{o(FB)} = 1.25V$	--	160	500	nA
Common-mode input voltage range	$V_{CC} = 3.6V$ to $40V$	1.05 to 1.45			V
Open-loop voltage amplification	$R_f = 200K\Omega$	70	80	--	dB
Unity-gain bandwidth		--	1.5	--	MHz
Common-mode rejection ratio		60	80	--	dB
Maximum output voltage		$V_{ref} - 0.1$	--	--	V
Minimum output voltage		--	--	1	V
Output sink current (FB)	$V_{ID} = -0.1, V_o = 1.25V$	0.5	1.6	--	mA
Output source current (FB)	$V_{ID} = 0.1, V_o = 1.25V$	-45	-70	--	uA

**PWM COMPARATOR SECTION**

Parameter	Test Conditions	Min	Typ	Max	Unit
Input threshold voltage (FB) $f = 10KHz$	Zero duty cycle	--	2.05	2.25	V
Input sink current (pin 3)	Maximum duty cycle	1.2	1.45	--	mA

**TOTAL DEVICE**

Parameter	Test Conditions	Min	Typ	Max	Unit
Standby supply current	Off-state	--	2.5	3.0	mA
Average supply current	$R_T = 10K\Omega$	--	2.8	3.5	

## Parameter Measurement Information

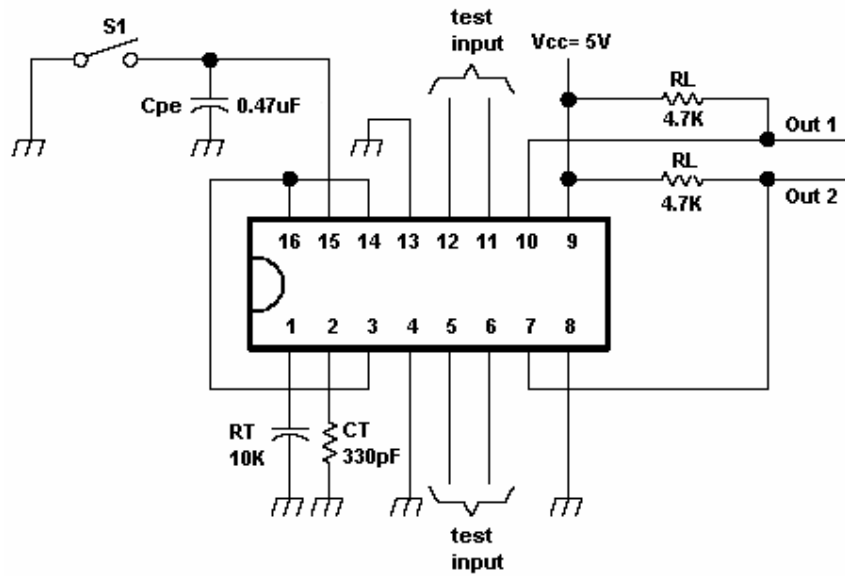
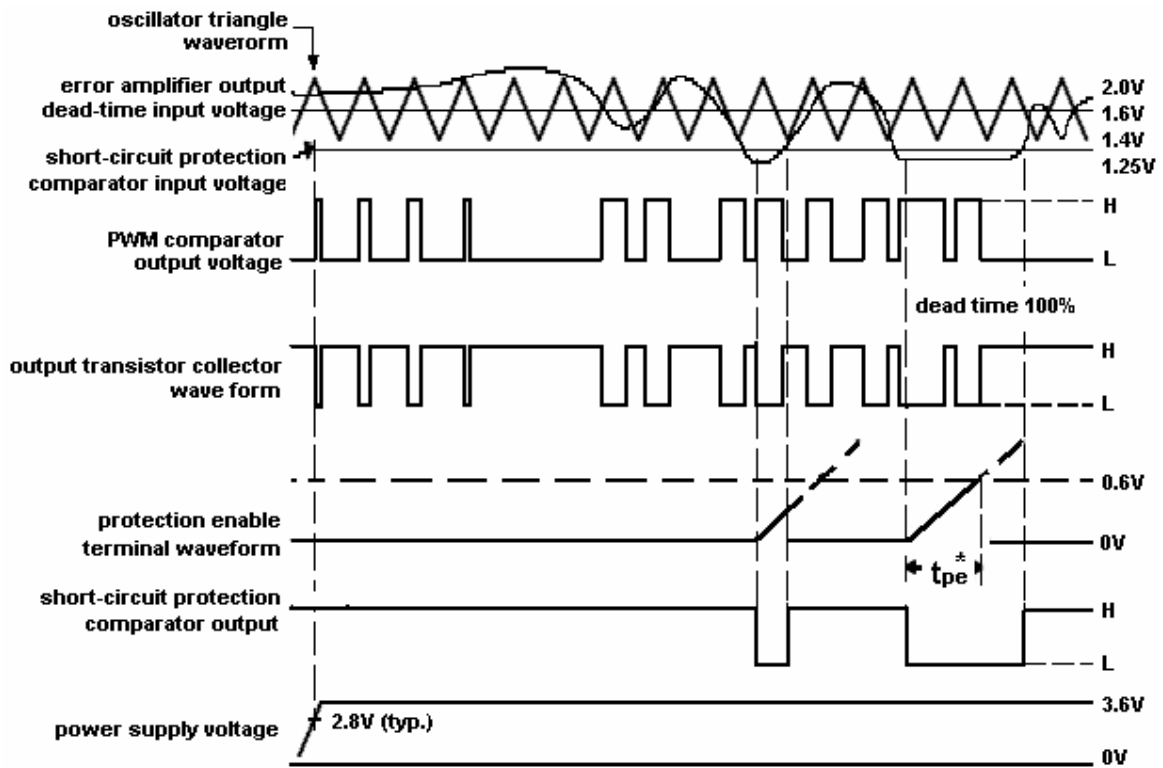


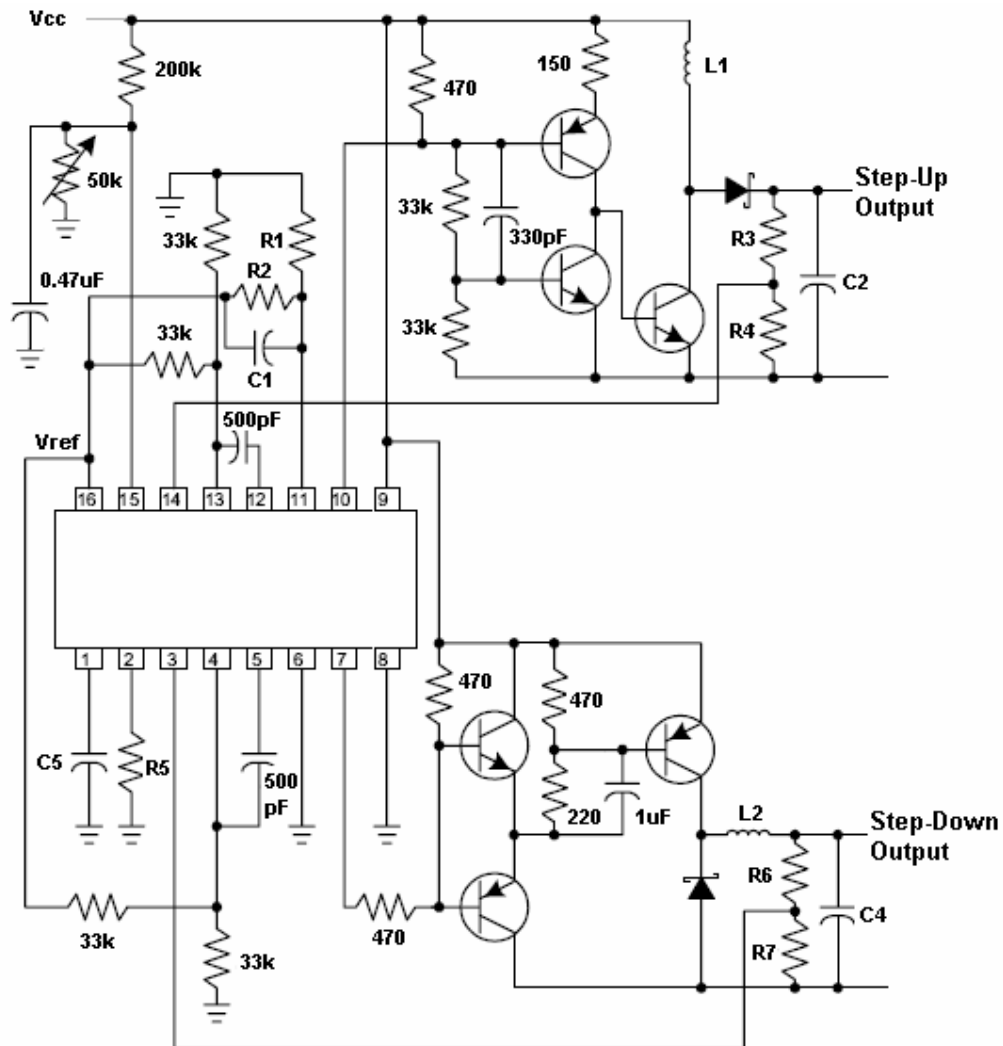
Fig 1. Test Circuit



\* protection enable time,  $t_{pe} = (0.051 \times 10^6 \times C_{pe})$  in seconds

Fig 2. Timing Diagram

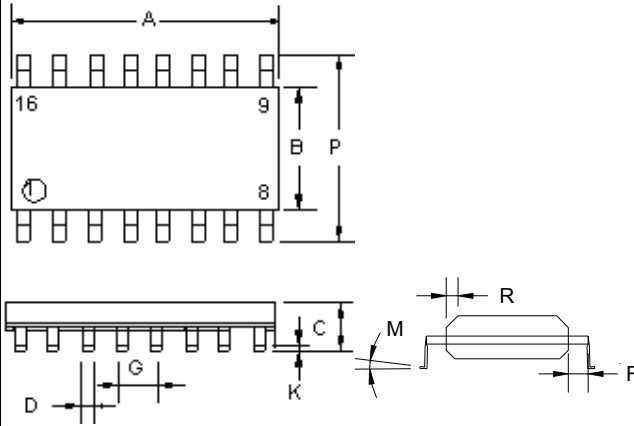
### Application Information



**Note:** Values for R1 thru R7, C1 thru C4, and L1 and L2 depend upon individual application

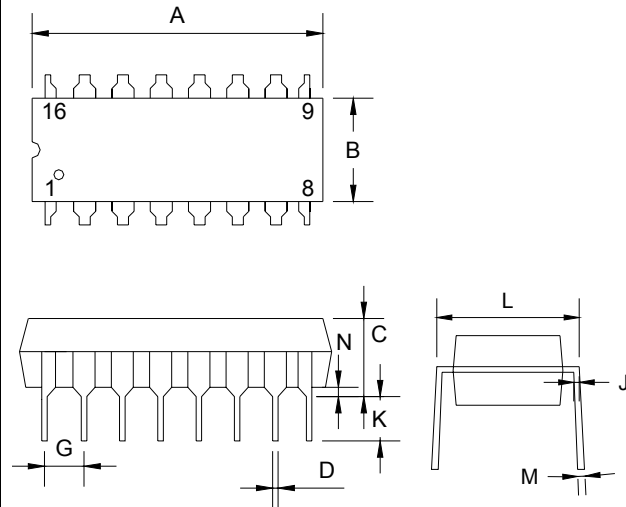
**Fig 3. High Speed Dual Switching Regulator**

## SOP-16 Mechanical Drawing



SOP-16 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 (typ)		0.05 (typ)	
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

## DIP-16 Mechanical Drawing



DIP-16 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	17.80	18.05	0.701	0.710
B	6.22	6.48	0.290	0.299
C	3.18	4.45	0.125	0.135
D	0.35	0.55	0.019	0.020
G	1.27 (typ)		0.05 (typ)	
J	0.25	0.31	0.010	0.012
K	3.25	3.35	0.128	0.132
L	7.75	8.00	0.305	0.315
M	-	10°	-	10°