

# TL494

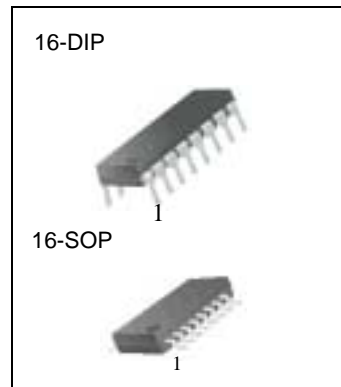
## SMPS Controller

### Features

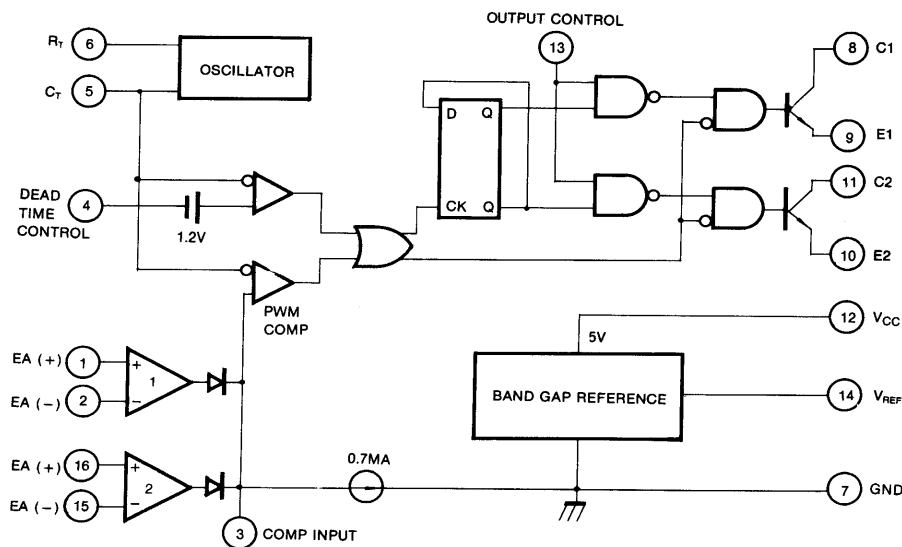
- Internal regulator provides a stable 5V reference supply trimmed to 5%
- Uncommitted output TR for 200mA sink or source current
- Output control for push-pull or single-ended operation
- Variable duty cycle by dead time control (pin 4) Complete PWM control circuit
- On-chip oscillator with master or slave operation
- Internal circuit prohibits double pulse at either output

### Description

The TL494 is used for the control circuit of the PWM switching regulator. The TL494 consists of 5V reference voltage circuit, two error amplifiers, flip flop, an output control circuit, a PWM comparator, a dead time comparator and an oscillator. This device can be operated in the switching frequency of 1 KHz to 300 KHz.



### Internal Block Diagram



**Absolute Maximum Ratings**

| Parameter                                 | Symbol           | Value                        | Unit |
|---|------------------|------------------------------|------|
| Supply Voltage                            | V <sub>CC</sub>  | 42                           | V    |
| Collector Supply Voltage                  | V <sub>C</sub>   | 42                           | V    |
| Output Current                            | I <sub>O</sub>   | 250                          | mA   |
| Amplifier Input Voltage                   | V <sub>IN</sub>  | V <sub>CC</sub> + 0.3        | V    |
| Power Dissipation (T <sub>A</sub> = 25°C) | P <sub>D</sub>   | 1 (TL494CN)<br>0.9 (TL494CD) | W    |
| Operating Temperature Range               | T <sub>OPR</sub> | 0 ~ +70                      | °C   |
| Storage Temperature Range                 | T <sub>STG</sub> | -65 ~ + 150                  | °C   |

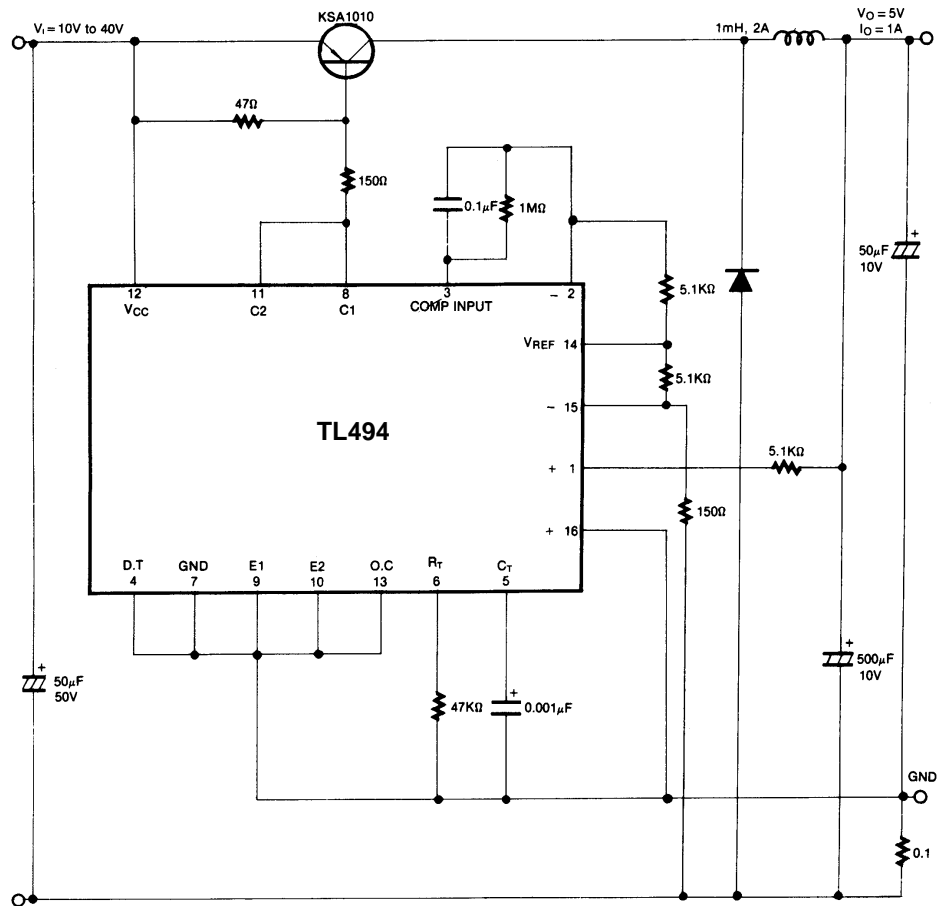
## Electrical Characteristics

( $V_{CC} = 20V$ ,  $f = 10KHz$ ,  $T_A = 0^{\circ}C$  to  $+70^{\circ}C$ , unless otherwise specified)

| Parameter                                   | Symbol   | Conditions                           | Min. | Typ. | Max. | Unit |
|---|----------|--------------------------------------|------|------|------|------|
| REFERENCE SECTION                           |          |                                      |      |      |      |      |
| Reference Output Voltage                    | VREF     | IREF = 1mA                           | 4.75 | 5.0  | 5.25 | V    |
| Line Regulation                             | ΔVREF    | VCC = 7V to 40V                      | -    | 2.0  | 25   | mV   |
| Temperature Coefficient of VREF             | ΔVREF/ΔT | TA = 0°C to 70°C                     | -    | 0.01 | 0.03 | %/°C |
| Load Regulation                             | ΔVREF    | IREF = 1mA to 10mA                   | -    | 1.0  | 15   | mV   |
| Short-Circuit Output Currnet                | ISC      | VREF = 0V                            | 10   | 35   | 50   | mA   |
| OSCILLATOR SECTION                          |          |                                      |      |      |      |      |
| Oscillation Frequency                       | f        | CT = 0.01μF, RT = 12KΩ               | -    | 10   | -    | KHz  |
| Frequency Change with Temperature           | Δf/ΔT    | CT = 0.01μF, RT = 12KΩ               | -    | -    | 2    | %    |
| DEAD TIME CONTROL SECTION                   |          |                                      |      |      |      |      |
| Input Bias Current                          | IBIAS    | VCC = 15V, 0V≤V4≤5.25V               | -    | -2.0 | -10  | μA   |
| Maximum Duty Cycle                          | D(MAX)   | VCC = 15V, V4 = 0V<br>O.C Pin = VREF | 45   | -    | -    | %    |
| Input Threshold Voltage                     | VITH     | Zero Duty Cycle                      | -    | 3.0  | 3.3  | V    |
|   |          | Max. Duty Cycle                      | 0    | -    | -    |      |
| ERROR AMP SECTION                           |          |                                      |      |      |      |      |
| Input Offset Voltage                        | VIO      | V3 = 2.5V                            | -    | 2.0  | 10   | mV   |
| Input Offset Current                        | IIO      | V3 = 2.5V                            | -    | 25   | 250  | mA   |
| Input Bias Current                          | IBIAS    | V3 = 2.5V                            | -    | 0.2  | 1.0  | μA   |
| Common Mode Input Voltage                   | VCM      | 7V ≤ VCC ≤ 40V                       | -0.3 | -    | VCC  | V    |
| Open-Loop Voltage Gain                      | GVO      | 0.5V ≤ V3 ≤3.5V                      | 70   | 95   | -    | dB   |
| Unit-Gain Bandwidth                         | BW       | -                                    | -    | 650  | -    | KHz  |
| PWM COMPARATOR SECTION                      |          |                                      |      |      |      |      |
| Input Threshold Voltage                     | VITH     | Zero Duty Cycle                      | -    | 4    | 4.5  | V    |
| Input Sink Currnet                          | ISINK    | V3=0.7V                              | -0.3 | -0.7 | -    | mV   |
| OUTPUT SECTION                              |          |                                      |      |      |      |      |
| Output Saturation Voltage<br>Common Emitter | VCE(SAT) | VE = 0, IC = 200mA                   | -    | 1.1  | 1.3  | V    |
| Common Collector                            | VCC(SAT) | VC = 15V, IE = -200mA                | -    | 1.5  | 2.5  |      |
| Collector Off-State Currnet                 | IC(OFF)  | VCC = 40V, VCE = 40V                 | -    | 2    | 100  | μA   |
| Emitter Off-State Current                   | IE(OFF)  | VCC = VC = 40V, VE = 0               | -    | -    | -100 |      |
| TOTAL DEVICE                                |          |                                      |      |      |      |      |
| Supply Current                              | ICC      | Pin 6 = VREF, VCC = 15V              | -    | 6    | 10   | mA   |
| OUTPUT SWITCHING CHARACTERISTIC             |          |                                      |      |      |      |      |
| Rise Time                                   | tR       | -                                    | -    | -    | -    | -    |
| Common Emitter                              | -        | -                                    | -    | 100  | 200  | ns   |
| Common Collector                            | -        | -                                    | -    | 100  | 200  |      |
| Fall Time                                   | tF       | -                                    | -    | -    | -    | -    |
| Common Emitter                              | -        | -                                    | -    | 25   | 100  | ns   |
| Common Collector                            | -        | -                                    | -    | 40   | 100  |      |

## Typical Application

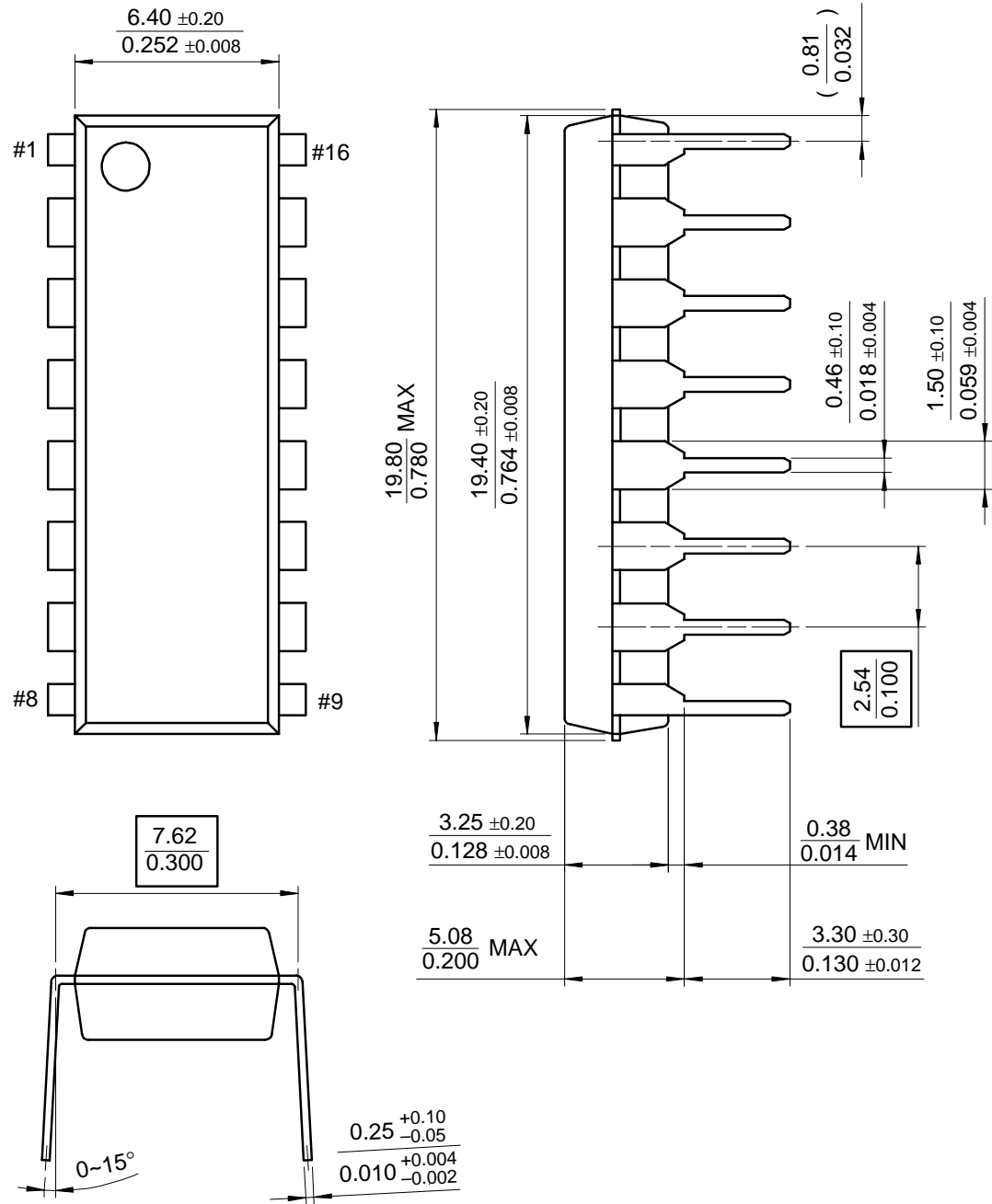
### Pulse Width Modulated Step-down Converter



Mechanical Dimensions

Package

16-DIP





## Ordering Information

| Product Number | Package | Operating Temperature |
|----------------|---------|-----------------------|
| TL494CN        | 16 DIP  | 0 ~ + 70°C            |
| TL494CD        | 16 SOP  |                       |

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