



TL494

LINEAR INTEGRATED CIRCUIT

VOLTAGE MODE PWM CONTROL CIRCUIT

DESCRIPTION

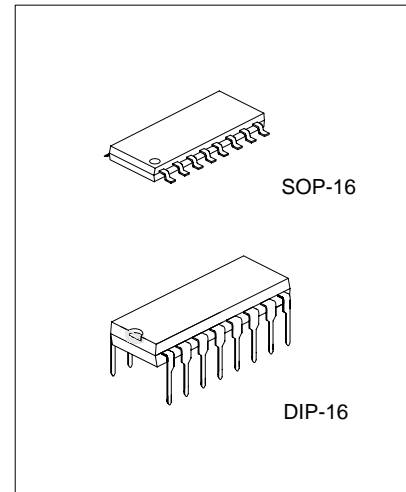
The UTC **TL494** incorporates all the functions required in the construction of a pulse-width modulation switching circuit. Designed primarily for switching power supply control or DC-DC converters, it offers the systems engineer the flexibility to tailor control circuitry to its own application.

FEATURES

- *Complete PWM power control circuitry
- *Uncommitted outputs for 200mA sink or source current
- *Output control selects single ended or push pull operation
- *Internal circuitry prohibits double pulses over total range
- *Easy synchronization

ORDERING INFORMATION

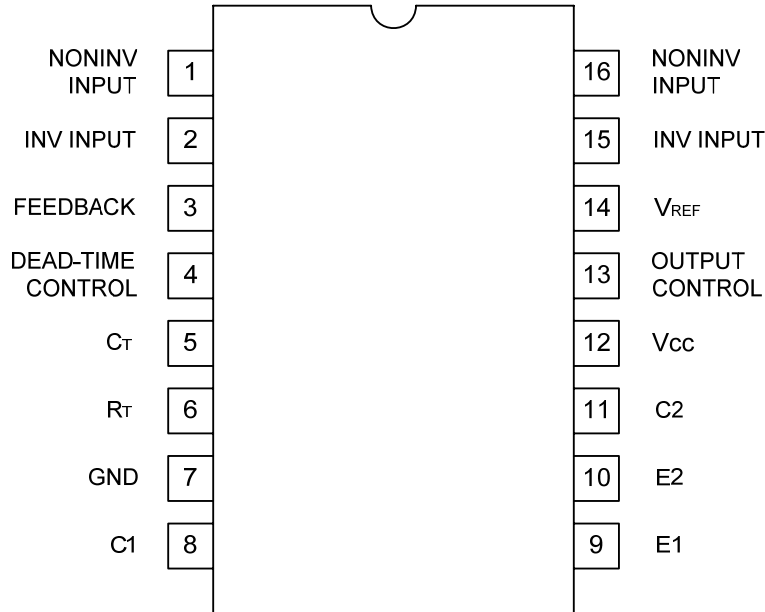
Order Number		Package	Packing
Normal	Lead Free Plating		
TL494-D16-T	TL494L-D16-T	DIP-16	Tube
TL494-S16-R	TL494L-S16-R	SOP-16	Tape Reel
TL494-S16-T	TL494L-S16-T	SOP-16	Tube



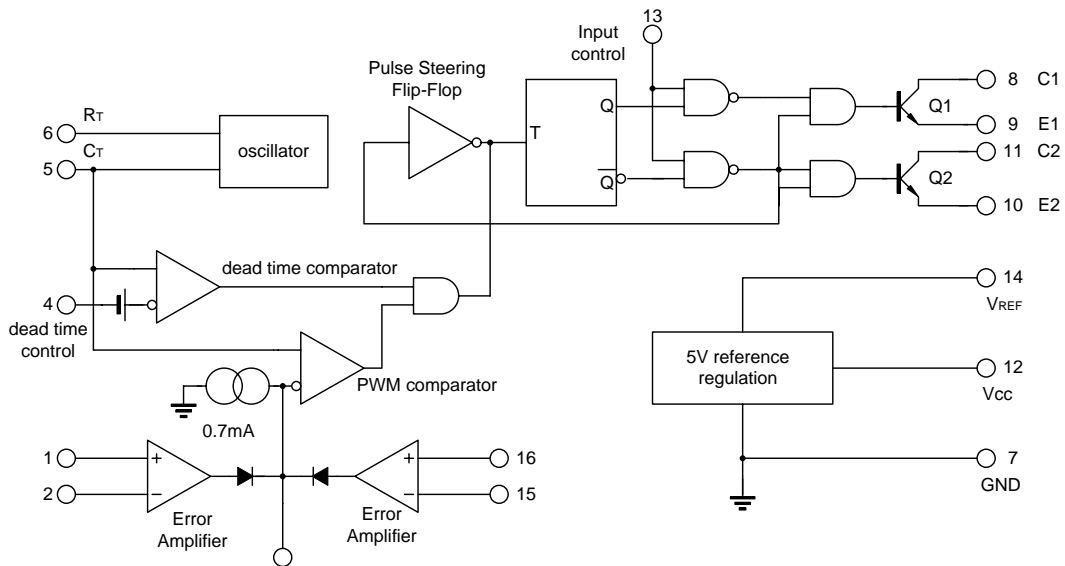
*Pb-free plating product number: TL494L

<p>TL494L-D16-T</p> <p>(1) Packing Type (2) Package Type (3) Lead Plating</p>	<p>(1) R: Tape Reel, T: Tube (2) D16: DIP-16, S16: SOP-16 (3) L: Lead Free Plating, Blank: Pb/Sn</p>
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■ PIN CONFIGURATIONS



■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

(Unless otherwise noted all is over operating free air temperature range)

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage(Note 3)		V_{CC}	41	V
Amplifier Input Voltage		V_{IN}	$V_{CC}+0.3$	V
Collector Output Voltage		V_{OUT}	41	V
Collector Output Current		I_{CO}	250	mA
Continuous Total Dissipation	Ta=25°C	P_D	1000	mW
	Derate at Ta > 25°C		9.2	mW/°C
Junction Temperature		T_J	125	°C
Operating Temperature		T_{OPR}	-25 ~ +85	°C
Storage Temperature		T_{STG}	-40 ~ +150	°C

Note 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. All voltage values, except differential voltages are with respect to the network ground terminal.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATINGS		UNIT
		MIN	MAX	
Supply Voltage	V_{CC}	7	40	V
Amplifier Input Voltage	V_{IN}	-0.3	$V_{CC}-2$	V
Collector Output Voltage	V_{OUT}		40	V
Collector Output Current(each Transistor)	I_C		200	mA
Current into Feedback	I_f		0.3	mA
Timing Capacitor	C_T	0.47	10000	nF
Timing Resistor	R_T	1.8	500	kΩ
Oscillator Frequency	fosc	1	300	kHz
Operating Free-Air Temperature	Ta	0	70	°C

ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range, $V_{CC}=15V, f=1kHz$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Reference Section						
Output Voltage	V_{OUT}	$I_{OUT}=1mA$	4.75	5	5.25	V
Input Regulation	V_{IN}	$V_{CC}=7V \sim 40V$		2	25	mV
Output Regulation	V_{OUT}	$I_{OUT}=1 \sim 10mA$		1	15	mV
Output Voltage Change with Temperature		$\Delta T_a=MIN \sim MAX$ (note 2)		0.2	1	%
Short-Circuit Output Current	$I_{O(SC)}$	$V_{REF}=0$		35		mA
Oscillator Section						
Frequency	F	$C_T=0.01\mu F, R_T=120k\Omega$		10		kHz
Standard Deviation of Frequency		All Values of V_{CC}, C_T, R_T, T_A constant		10		%
Frequency Change with Voltage		$V_{CC}=7V \sim 40V, T_a=25^\circ C$		0.1		%
Frequency Change with Temperature		$C_T=0.01\mu F, R_T=12k\Omega, \Delta T_a=MIN \sim MAX$			12	%
Amplifier Section						
Input Offset Voltage	Error	$V_{I(OFF)}$	$V_{OUT}(\text{pin } 3)=2.5V$	2	10	mV
Input Offset Current		$I_{I(OFF)}$	$V_{OUT}(\text{pin } 3)=2.5V$		25	250 nA
Input Bias Current		$I_{I(BIAS)}$	$V_{OUT}(\text{pin } 3)=2.5V$		0.2	1 μA
Common-Mode Input Voltage Range	Error		$V_{CC}=7V \sim 40V$	-0.3 ~ $V_{CC}-2$		V
Open-Loop Voltage Amplification			$\Delta V_{OUT}=3V, V_{OUT}=0.5V \sim 3.5V$	70	95	dB
Unity-Gain Bandwidth		GB_W			800	kHz
Common-Mode Rejection Ratio	Error	CMRR	$V_{CC}=40V, T_a=25^\circ C$	65	80	dB
Output Sink Current(pin 3)		$I_{O(SINK)}$	$V_{ID}=-15mV \sim -5V$ $V(\text{pin } 3)=0.5V$	0.3	0.7	mA
Output source Current(pin 3)		$I_{O(SOURCE)}$	$V_{ID}=15mV \sim -5V, V(\text{pin } 3)=3.5V$	-2		mA
Output Section						
Collector off-state current		$I_{C(OFF)}$	$V_{CE}=40V, V_{CC}=40V$		2	100 μA
Emitter off-state Current		$I_{E(OFF)}$	$V_{CC}=V_C=40V, V_E=0$			-100 μA
Collector -emitter Saturation Voltage	Common-emitter		$V_E=0, I_C=200mA$		1.1	1.3 V
	Emitter-Follower		$V_C=15V, I_E=-200mA$		1.5	2.5
Output Control Input Current			$V_{IN}=V_{REF}$			3.5 mA
Dead Time Control Section						
Input bias (pin 4)		$I_{I(BIAS)}$	$V_{IN}=0 \sim 5.25V$		-2	-10 μA
Maximum duty cycle, each output			$V_{IN}(\text{pin } 4)=0$	45		%
Input threshold Voltage(pin 4)		V_{THR}	Zero duty Cycle		3	3.3 V
			Maximum duty cycle	0		
PWM comparator Section						
Input Threshold Voltage(pin 3)		V_{THR}	Zero Duty cycle		4	4.5 V
Input Sink Current (pin 3)		$I_{I(SINK)}$	$V_{pin } 3=0.7V$	0.3	0.7	mA
Total Device						
Standby Supply Current	$V_{CC}=15V$ $V_{CC}=40V$	I_{ST-BY}	pin 6 at V_{REF} , all other Inputs and outputs open		6	10 mA
Average supply current			$V_{pin } 4=2V$		9	15 mA
					7.5	mA
Switching Characteristics, $T_a=25^\circ C$						
Output Voltage Rise Time	t_R		Common-emitter configuration		100	200 ns
Output Voltage Fall Time	t_F				25	100 ns
Output Voltage Rise Time	t_R		Emitter-follower configuration		100	200 ns
Output Voltage Fall Time	t_F				40	100 ns

Note 1: All typical Values except for temperature coefficient are at $T_a=25^\circ C$.

Note 2: For conditions shown as MIN or MAX, use appropriate value under recommended operating conditions.

Note 3: Duration of the short-circuit should not exceed one second.

Note 4: Standard deviation is a measure of the statistical distribution the mean as derived from the formula:

$$\sigma = \sqrt{\frac{\sum_{n=1}^N (x_n - \bar{x})^2}{N-1}}$$

■ TEST CIRCUIT

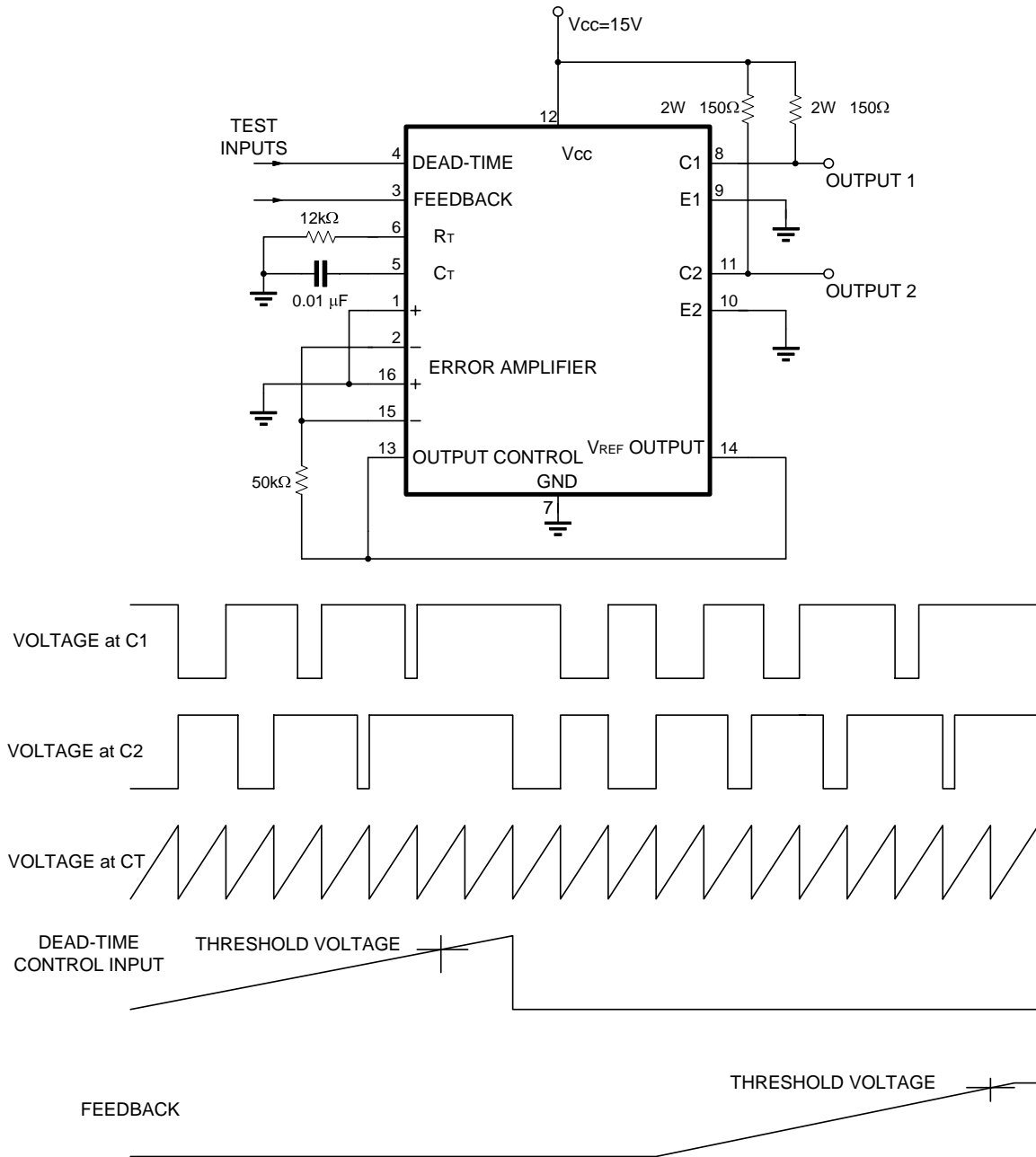


FIG 1. OPERATIONAL TEST CIRCUIT AND WAVEFORMS

■ TEST CIRCUIT(Cont.)

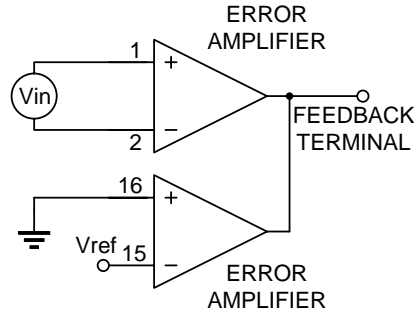


FIG 2. AMPLIFIER CHARACTERISTICS

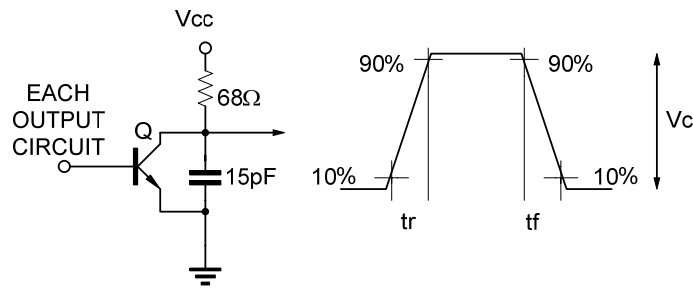


FIG. 3 COMMON-EMITTER CONFIGURATION

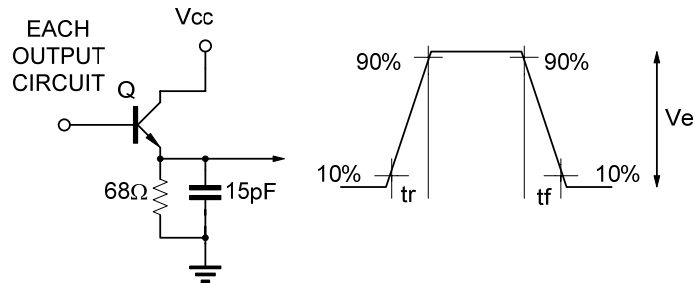
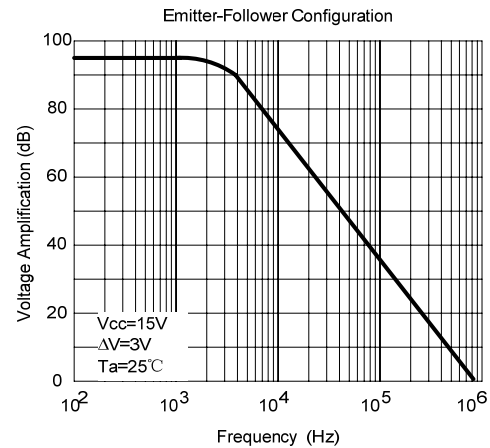
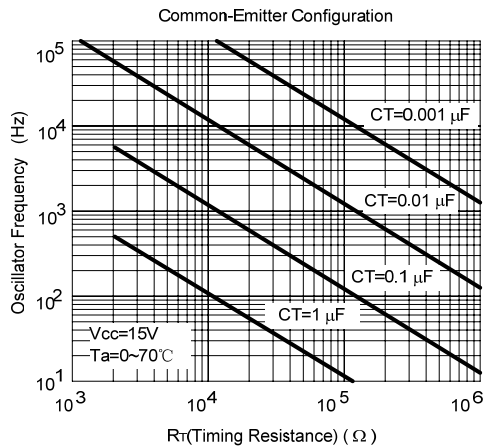


FIG. 4 EMITTER-FOLLOWER CONFIGURATION

■ TYPICAL PERFORMANCE CHARACTERISTICS



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