

# TL494

# LINEAR INTEGRATED CIRCUIT

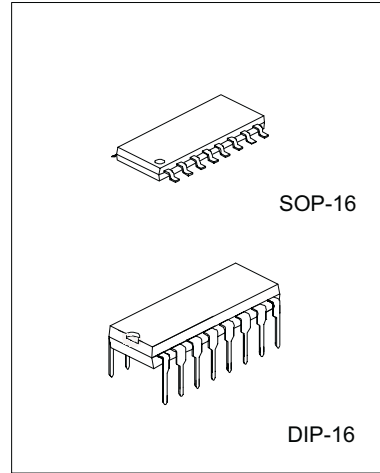
## VOLTAGE MODE PWM CONTROL CIRCUIT

### DESCRIPTION

The Contek 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 200 mA sink or source current
- \*Output control selects single ended or push pull operation
- \*Internal circuitry prohibits double pulses over total range
- \*Easy synchronization



**ABSOLUTE MAXIMUM RATINGS**(Unless otherwise noted all is over operating free air temperature range)

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage(note 1)	$V_{CC}$	41	V
Amplifier Input Voltage	$V_I$	$V_{CC}+0.3$	V
Collector Output Voltage	$V_O$	41	V
Collector Output Current	$I_{CO}$	250	mA
Continuous Total Dissipation at(or for below) 25 C Free Air Temperature(note 2)	$P_D$	1000	mW
Operating Temperature Range	$T_{opr}$	0 TO 70	C
Storage Temperature Range	$T_{sta}$	-65 TO 150	C
Lead Temperature 1.6mm from Case for 60 Sec.	$T_{case}$	300	C

note 1: All voltage values, except differential voltages are with respect to the network ground terminal.

note 2:For operation above 25 C free-air temperature, the dissipation derates with 9.2mW/ C.



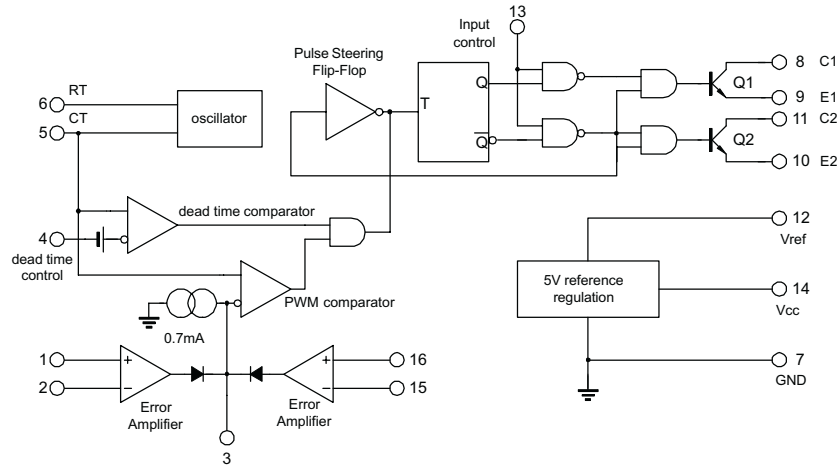
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## BLOCK DIAGRAM



## RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE		UNIT
		MIN	MAX	
Supply Voltage	V <sub>cc</sub>	7	40	V
Amplifier Input Voltage	V <sub>i</sub>	-0.3	V <sub>cc</sub> -2	V
Collector Output Voltage	V <sub>o</sub>		40	V
Collector Output Current(each Transistor)	I <sub>c</sub>		200	mA
Current into Feedback	I <sub>f</sub>		0.3	mA
Timing Capacitor	C <sub>T</sub>	0.47	10000	nF
Timing Resistor	R <sub>T</sub>	1.8	500	kΩ
Oscillator Frequency	f <sub>osc</sub>	1	300	kHz
Operating Free-Air Temperature	T <sub>a</sub>	0	70	C

## ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range, V<sub>cc</sub>=15V, f=1kHz, Unless otherwise specified)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Reference Section</b>					
Output Voltage	I <sub>o</sub> =1mA	4.75	5	5.25	V
Input Regulation	V <sub>cc</sub> =7V to 40V		2	25	mV
Output Regulation	I <sub>o</sub> =1 to 10mA		1	15	mV
Output Voltage Change with Temperature	ΔT <sub>A</sub> =MIN to MAX(note 2)		0.2	1	%
Short-Circuit Output Current	V <sub>ref</sub> =0		35		mA
<b>Oscillator Section</b>					
Frequency	C <sub>T</sub> =0.01μF, R <sub>T</sub> =120kΩ		10		kHz



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PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Standard Deviation of Frequency		All Values of Vcc CT, RT, TA constant		10		%
Frequency Change with Voltage		Vcc=7V to 40V, Ta=25 C		0.1		%
Frequency Change with Temperature		CT=0.01μF, RT=12kΩ, ΔTA=MIN to MAX			12	%
<b>Amplifier Section</b>						
Input Offset Voltage	Error	Vo(pin 3)=2.5V		2	10	mV
Input Offset Current		Vo(pin 3)=2.5V		25	250	nA
Input Bias Current		Vo(pin 3)=2.5V		0.2	1	μA
Common-Mode Input Voltage Range	Error	Vcc=7V to 40 V	-0.3 to Vcc-2			V
Open-Loop Voltage Amplification		ΔVo=3V, Vo=0.5V to 3.5V	70	95		dB
Unity-Gain Bandwidth				800		KHz
Common-Mode Rejection Ratio	Error	Vcc=40V, TA=25 C	65	80		dB
Output Sink Current(pin 3)		VID=-15mV to -5V V(pin 3)=0.5V	0.3	0.7		mA
Output source Current(pin 3)		VID=15mV to -5V V(pin 3)=3.5V	-2			mA
<b>Output Section</b>						
Collector off-state current		VCE=40V, Vcc=40V		2	100	μA
Emitter off-state Current		VCC=VC=40V, VE=0			-100	μA
Collector -emitter Saturation Voltage	Common-emitter	VE=0, Ic=200mA		1.1	1.3	V
	Emitter-Follower	Vc=15V, IE=-200mA		1.5	2.5	
Output Control Input Current		Vi=Vref			3.5	mA
<b>Dead Time Control Section</b>						
Input bias (pin 4)		Vi=0 to 5.25V		-2	-10	μA
Maximum duty cycle, each output		VI(pin 4)=0	45			%
Input threshold Voltage(pin 4)		Zero duty Cycle		3	3.3	V
		Maximum duty cycle	0			
<b>PWM comparator Section</b>						
Input Threshold Voltage(pin 3)		Zero Duty cycle		4	4.5	V
Input Sink Current (pin 3)		Vpin 3= 0.7V	0.3	0.7		mA
<b>Total Device</b>						
Standby Supply Current	Vcc=15V	pin 6 at Vref, all other Inputs and outputs open		6	10	mA
	Vcc=40V			9	15	
Average supply current		Vpin 4=2V		7.5		mA
<b>Switching Characteristics, Ta=25 C</b>						
Output Voltage Rise Time		Common-emitter configuration		100	200	ns
Output Voltage Fall Time				25	100	ns
Output Voltage Rise Time		Emitter-follower configuration		100	200	ns
Output Voltage Fall Time				40	100	ns

note 1: All typical Values except for temperature coefficient are at Ta=25 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.



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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

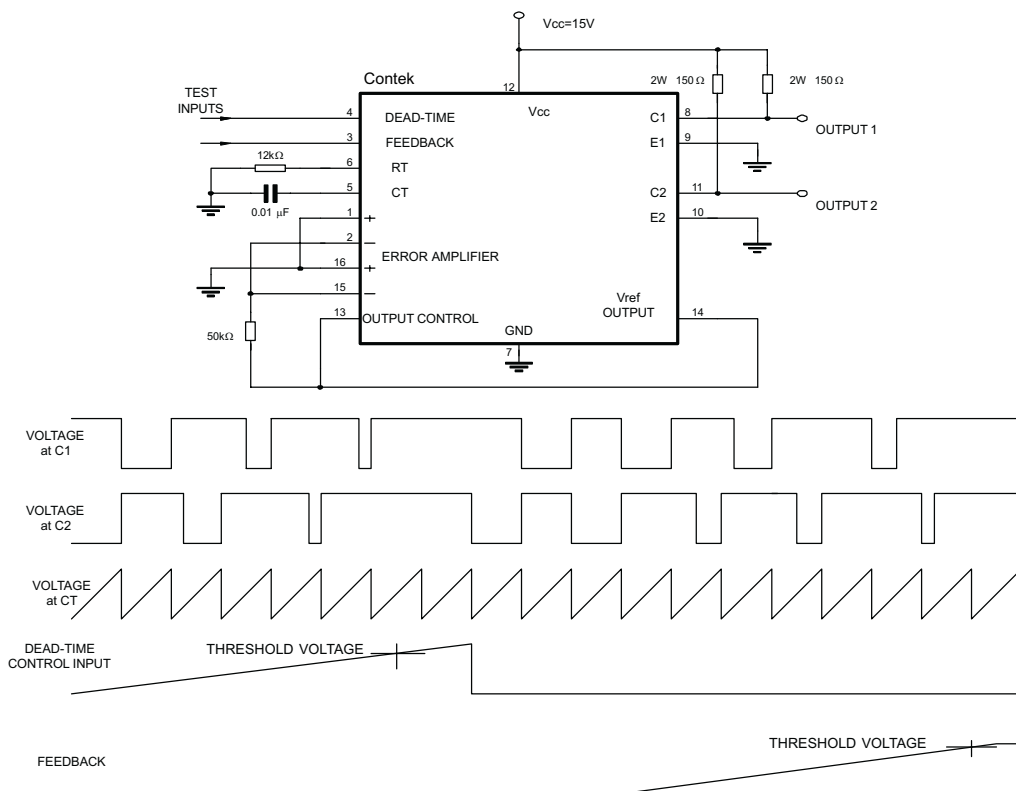


FIG 1. OPERATIONAL TEST CIRCUIT AND WAVEFORMS



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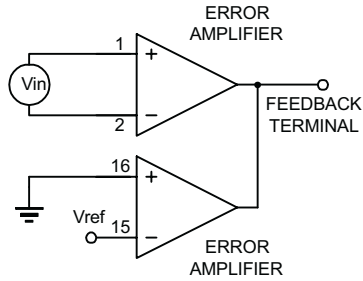


FIG 2. AMPLIFIER CHARACTERISTICS

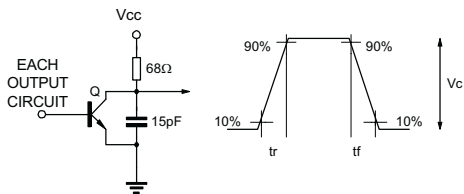


FIG. 3 COMMON-EMITTER CONFIGURATION

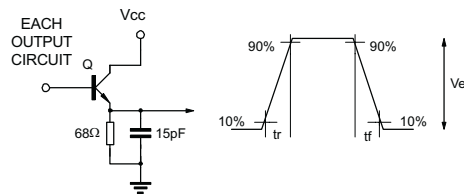
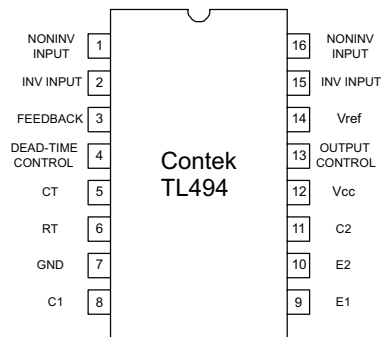


FIG. 4 EMITTER-FOLLOWER CONFIGURATION

PIN CONFIGURATIONS



TYPICAL PERFORMANCE CHARACTERISTICS

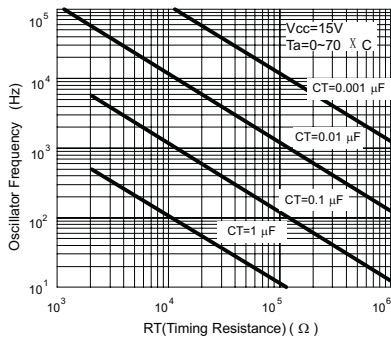


FIG 5. Oscillator Frequency and Frequency Variation Vs Timing Resistance

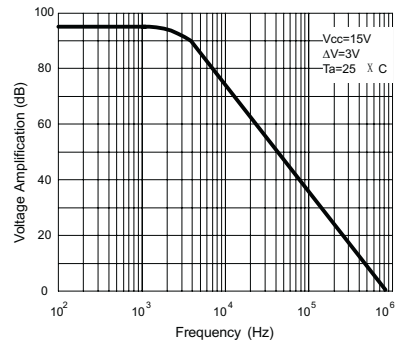


Fig.6 Amplifier Voltage Amplification