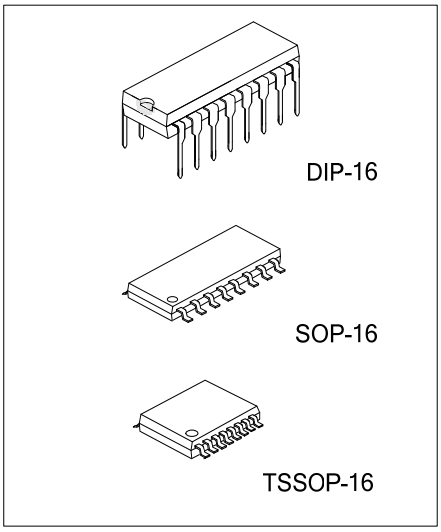
TL494

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 convectors, 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

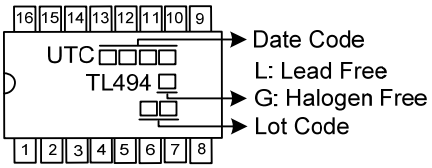
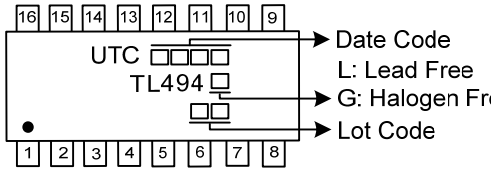
Ordering Number		Package	Packing
Lead Free	Halogen Free		
TL494L-D16-T	TL494G-D16-T	DIP-16	Tube
TL494L-S16-R	TL494G-S16-R	SOP-16	Tape Reel
TL494L-P16-R	TL494G-P16-R	TSSOP-16	Tape Reel

TL494G-D16-T

(1)Packing Type
(2)Package Type
(3)Green Package

(1) T: Tube, R: Tape Reel
(2) D16: DIP-16, S16: SOP-16, P16: TSSOP-16
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

DIP-16	SOP-16 / TSSOP-16
	

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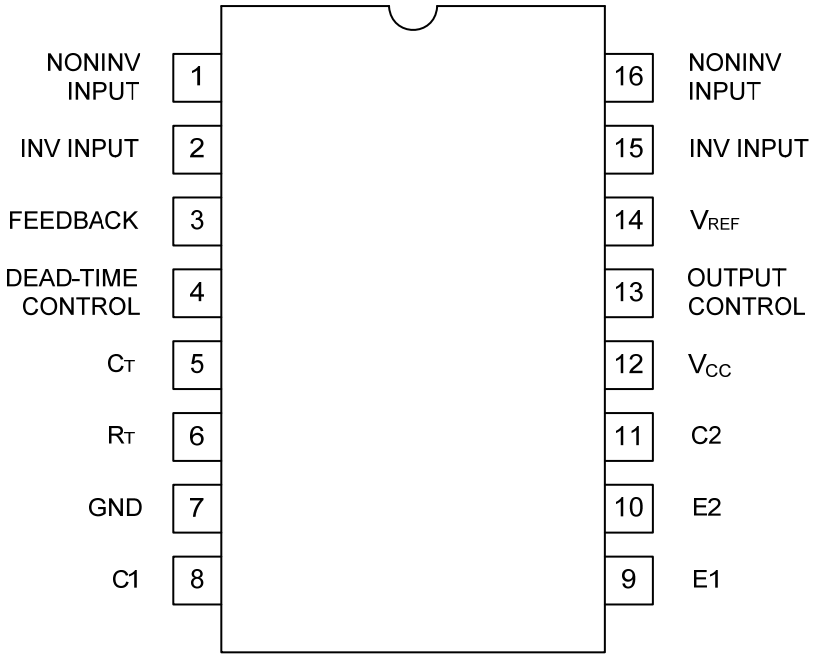
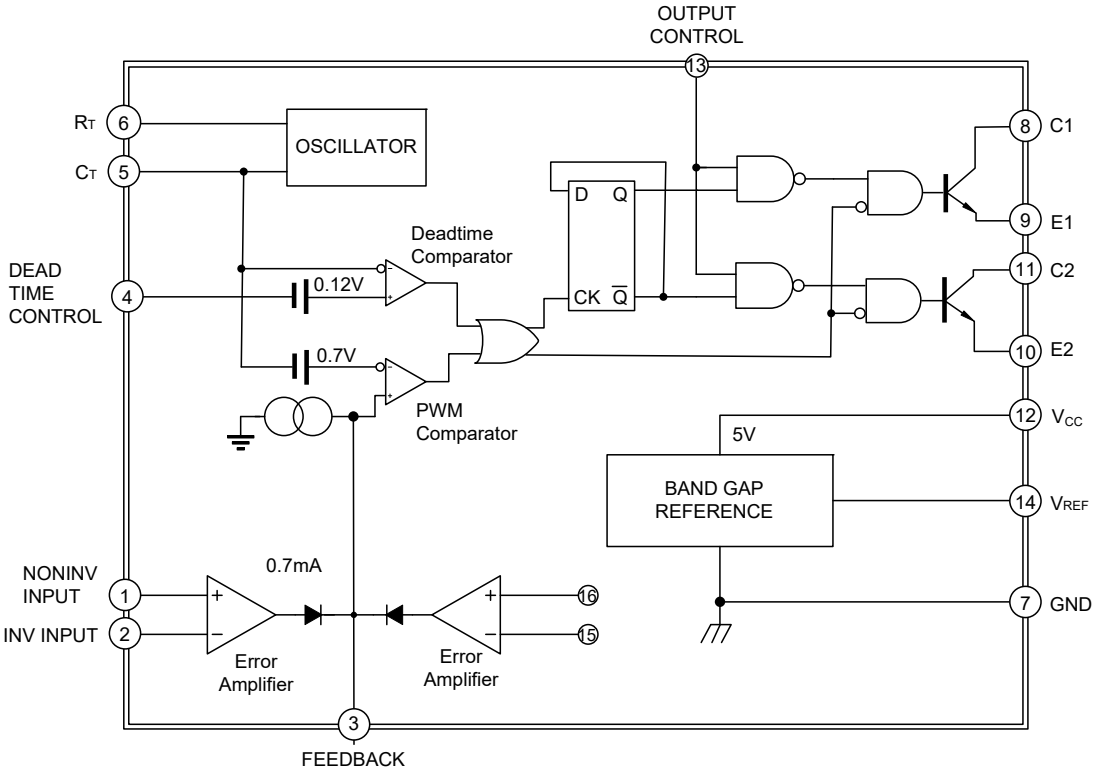
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN No.	SYMBAL	NAME AND FUNCTION
1, 16	NONINV INPUT	Error Amplifier NONINV Input
2, 15	INV INPUT	Error Amplifier INV Input
3	FEEDBACK	Output Feedback Voltage
4	DEAD-TIME CONTROL	Output DEAD-TIME Control
5	CT	Timing Capacitor
6	RT	Timing Resistor
7	GND	Ground
8	C1	Internal Power NPN Collect1
9	E1	Internal Power NPN Emitter1
10	E2	Internal Power NPN Emitter2
11	C2	Internal Power NPN Collect2
12	V_{CC}	Supply Voltage
13	OUTPUT CONTROL	Output mode select
14	V_{REF}	Reference Voltage

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (unless otherwise specified)

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
Power Dissipation (T_A=25°C)	P_D	1000	mW
Derate at T_A＞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

Notes: 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	MIN	TYP	MAX	UNIT
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	f_{OSC}	1		300	kHz

■ 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 ~ 40V		2	25	mV
Output Regulation	V_{OUT}	I_{OUT}=1 ~ 10mA		1	15	mV
Output Voltage Change with Temperature		ΔT_A=MIN ~ MAX(note 2)		0.2	1	%
Short-Circuit Output Current	$I_{O(SC)}$	V_{REF}=0		35		mA
OSCILLATOR SECTION						
Frequency	F	C_T=0.01μF, R_T=12kΩ		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 ~ 40V,Ta=25°C		0.1		%
Frequency Change with Temperature		C_T=0.01μF, R_T=12kΩ, ΔT_A=MIN ~ MAX			12	%

■ ELECTRICAL CHARACTERISTICS (Cont.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
AMPLIFIER SECTION							
Input Offset Voltage	Error	$V_{I(OFF)}$	V_{OUT} (pin 3)=2.5V		2	10	mV
Input Offset Current		$I_{I(OFF)}$	V_{OUT} (pin 3)=2.5V		25	250	nA
Input Bias Current		$I_{I(BIAS)}$	V_{OUT} (pin 3)=2.5V		0.2	1	μA
Common-Mode Input Voltage Range	Error		V_{CC}=7V ~ 40 V	-0.3 ~ V_{CC}-2			V
Open-Loop Voltage Amplification			ΔV_{OUT}=3V, V_{OUT}=0.5V ~ 3.5V	70	95		dB
Unity-Gain Bandwidth		GB_W			800		kHz
Common-Mode Rejection Ratio	Error	CMRR	V_{CC}=40V,T_A=25°C	65	80		dB
Output Sink Current(pin 3)		$I_{O(SINK)}$	V_{ID}=-15mV ~ -5V, V(pin 3)=0.5V	0.3	0.7		mA
Output source Current(pin 3)		$I_{O(SOURCE)}$	V_{ID}=15mV ~ -5V, V(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 ~ 5.25V		-2	-10	μA
Maximum duty cycle, each output			V_{IN}(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	I_{ST-BY}	pin 6 at V_{REF}, all other Inputs and outputs open		6	10	mA
	V_{CC} =40V				9	15	
Average supply current			V(pin 4)=2V		7.5		mA
SWITCHING CHARACTERISTICS, TA=25°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

Notes: 1. All typical Values except for temperature coefficient are at T_A=25°C.

2. For conditions shown as MIN or MAX, use appropriate value under recommended operating conditions.
3. Duration of the short-circuit should not exceed one second.
4. Standard deviation is a measure of the statistical distribution the mean as derived from the formula:

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

■ TEST CIRCUIT

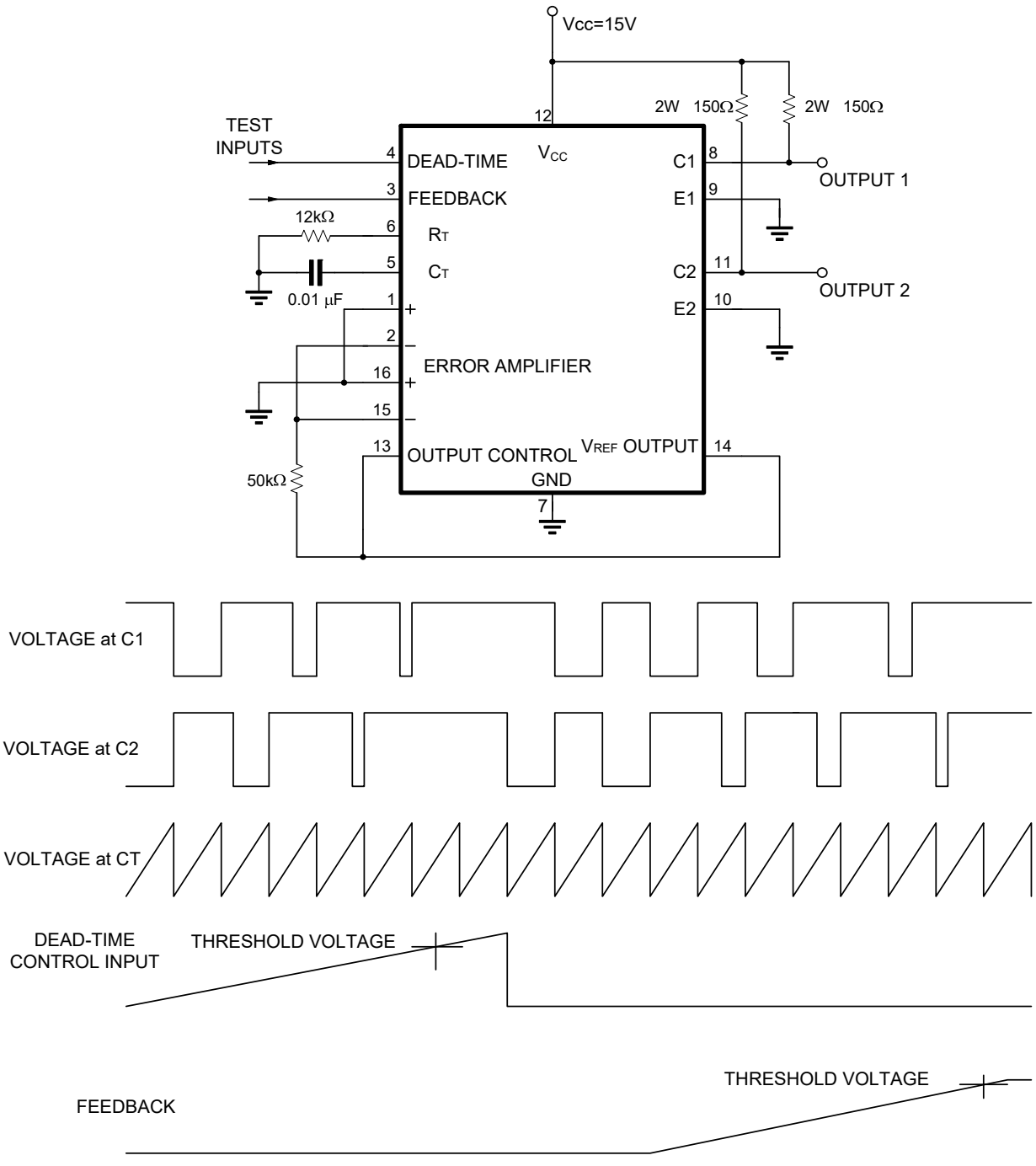


Figure 1. OPERATIONAL TEST CIRCUIT AND WAVEFORMS

■ TEST CIRCUIT(Cont.)

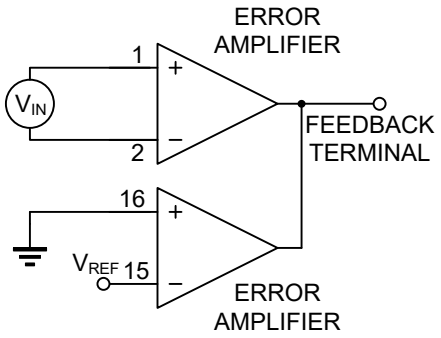


Figure 2. AMPLIFIER CHARACTERISTICS

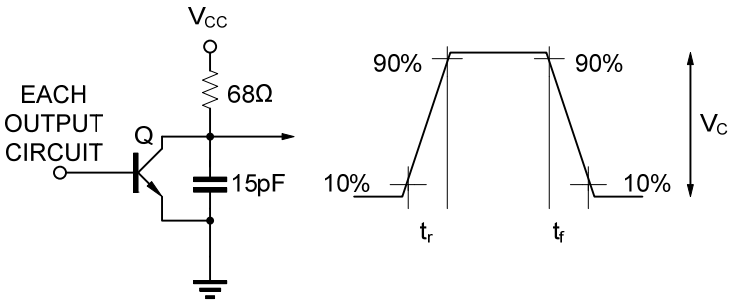


Figure 3. COMMON-EMITTER CONFIGURATION

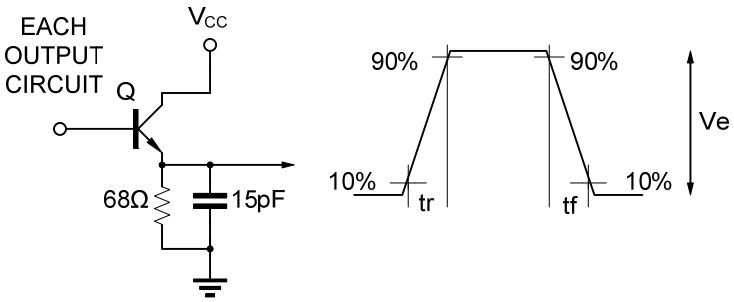
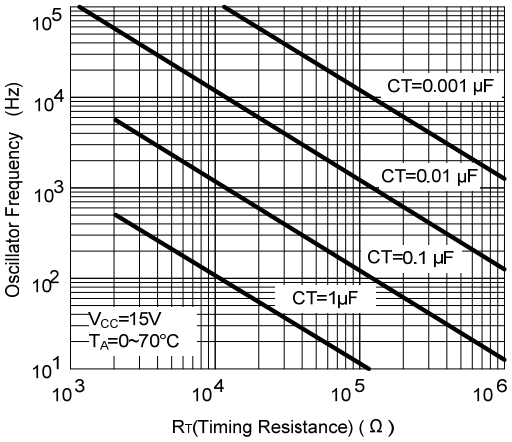


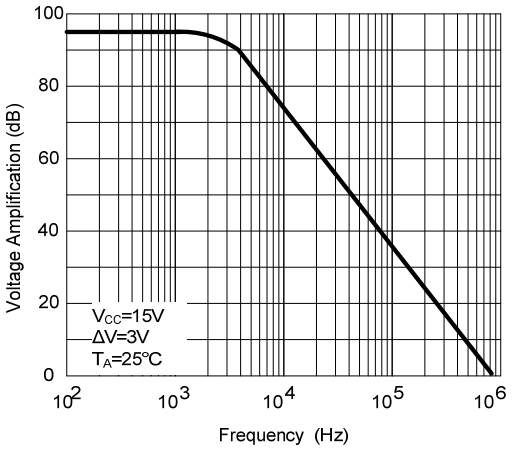
Figure 4. EMITTER -FOLLOWER CONFIGURATION

■ TYPICAL PERFORMANCE CHARACTERISTICS

Common-Emitter Configuration



Emitter-Follower Configuration



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