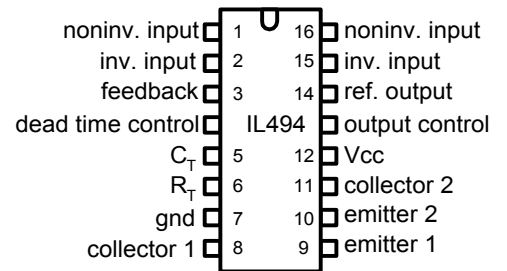


# IL494

## PWM Control Circuit

### Description

The IL494 incorporates on a single monolithic chip all the function required in the development of a pulse - width modulation control circuits. Designed primarily for power supply control , the IL494 contains an on-chip 5 volt regulator, two error amplifiers, adjustable oscillator, dead time control comparator, pulse-steering flip-flop, and output control circuitry. The uncommitted output transistors provide either common-emitter or emitter-follower output capability. Push-pull or single-ended output operation may be selected through the output-control function. The architecture of the IL494 prohibits the possibility of either output being pulsed twice during push-pull operation.

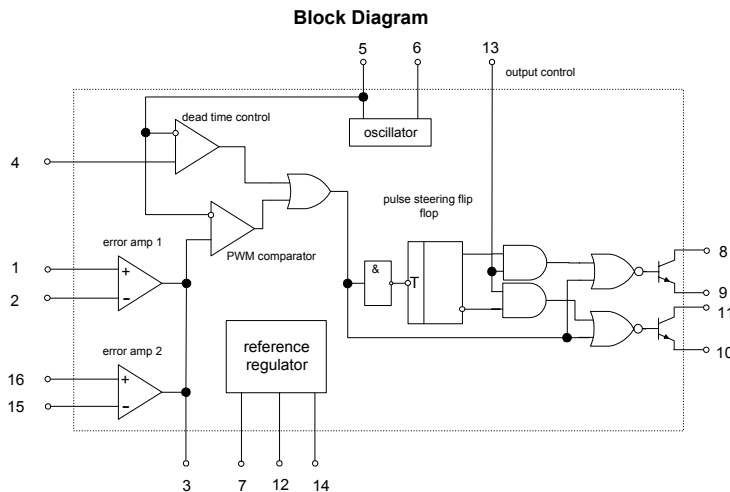


### Features

- Complete PWM Power Control Circuitry
- Uncommitted Outputs for 200 mA Sink or Source
- Output Control Selects Single-Ended or Push-Pull Operation
- Internal Circuitry Prohibits Double Pulse at Either Output
- Internal Regulator Provides a Stable 5V Reference Supply
- Variable Dead-Time Provides Control Over Whole Range

### Function Table

Output Control	Output Function
Grounded	Single-ended or Parallel Output
At $V_{ref}$	Normal Push-Pull Operation



Standard deviation is derived from the formula

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

### DISSIPATION RATING TABLE

PACKAGE	$T_A = 25^\circ\text{C}$ POWER RATING	OPERATING FACTOR	DERATE ABOVE $T_A$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING
D	900 mW	7.6 mW/ $^\circ\text{C}$	25 $^\circ\text{C}$	608 mW	494 mW
N	1000 mW	9.2 mW/ $^\circ\text{C}$	41 $^\circ\text{C}$	736 mW	598 mW

## RECOMMENDED OPERATION CONDITIONS

PARAMETER	MIN	MAX	UNIT
Supply Voltage	7	40	V
Amplifier Input Voltage	-0.3	V <sub>CC</sub> -2	V
Collector Output Voltage		40	V
Collector Output Current (Each Transistor)		200	mA
Current Into Feedback Terminal		0.3	mA
Timing Capacitor	0.47	10000	nF
Timing Resistor	1.8	500	kΩ
Oscillator Frequency	1	300	kHz
Operating Free-Air Temperature	-20	85	°C

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage	41V
Amplifier Input Voltage	V <sub>CC</sub> +0.3V
Collector Output Voltage	41V
Continuous Total Dissipation at (or below) 25°C	1000mW
Operating Free-Air Temperature Range	-20 to 85°C
Storage Temperature Range	-65 to 150°C
Collector Output Current	250mA

Electrical Characteristics (Temperature -20...85°C, V<sub>CC</sub>=15V, f=10kHz)

## REFERENCE SECTION

PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
Output voltage (V <sub>ref</sub> )	I <sub>o</sub> =1mA	4.75	5.25	V
Input regulation	V <sub>CC</sub> =7V to 40V, T <sub>a</sub> =25°C		25	mV
Output regulation	I <sub>o</sub> =1 to 10mA, T <sub>a</sub> =25°C		15	mV
Output voltage change with temperature	T <sub>a</sub> =-20°C to 85°C		1	%
Short circuit output current	V <sub>ref</sub>		60	mV

## DEAD TIME CONTROL SECTION

PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
Input bias current (pin 4)	V <sub>i</sub> =0V to 5.25V		-10	μA
Maximum duty cycle (each output)	V <sub>i(pin 4)</sub> =0V	45		%
Input threshold voltage (pin 4)	zero duty cycle		3.3	V
	maximum duty cycle	0		V

## ERROR AMPLIFIERS SECTION

PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
Input offset voltage	V <sub>o(pin 3)</sub> =2.5		10	mV
Input offset current	V <sub>o(pin 3)</sub> =2.5		250	nA
Input bias current	V <sub>o(pin 3)</sub> =2.5		1	μA
Common mode input voltage range	V <sub>CC</sub> =7 to 40V	LOW	-0.3	V
		HIGH	V <sub>CC</sub> -2	V
Open loop voltage amplification	ΔV <sub>o</sub> =3V, V <sub>o</sub> =0.5 to 3.5V	70		dB
Unity-gain bandwidth		100		kHz
Common mode rejection ratio	V <sub>CC</sub> =40V, T <sub>a</sub> =25°C	65		dB
Output sink current (pin 3)	V <sub>ID</sub> =-15mV to -5V, V <sub>o(pin 3)</sub> =0.7V	0.3		mA
Output source current (pin 3)	V <sub>ID</sub> =15mV to 5V, V <sub>o(pin 3)</sub> =3.5V	-2		mA

# IL494

## PWM COMPARATOR SECTION

PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
Input threshold voltage (pin 3)	zero duty cycle		4.5	V
Input sink current (pin 3)	$V_{o(\text{pin } 3)}=0.7\text{V}$	0.3		mA

## SWITCHING CHARACTERISTICS

PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
Output voltage rise time	Common emitter		200	ns
Output voltage fall time	configuration		100	ns
Output voltage rise time	Emitter-follower		200	ns
Output voltage fall time	configuration		100	ns

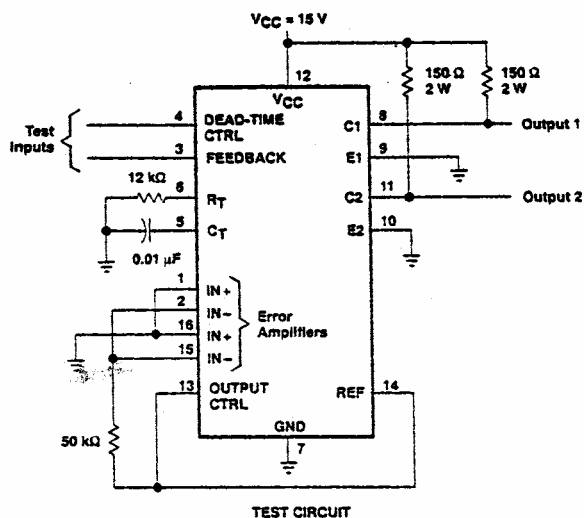
## OUTPUT SECTION

PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
Collector off-state current	$V_{CE}=40\text{V}, V_{CC}=40\text{V}$		100	$\mu\text{A}$
Emitter off-state current	$V_{CC}=V_C=40\text{V}, V_E=40\text{V}$		-100	$\mu\text{A}$
Collector - Emitter saturation voltage	Common emitter $V_E=0, I_C=200\text{mA}$		1.3	V
	Emitter-follower $V_C=15\text{V}, I_E=-200\text{mA}$		2.5	V
Output control input current	$V_i=V_{\text{ref}}$		3.5	mA

## OSCILLATOR SECTION

PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
Frequency	$C_T=0.01\mu\text{F}, R_T=12\text{k}\Omega$		30	kHz
Standard deviation of frequency	All Values of $V_{CC}, C_T, R_T, T_a$ are constant		30	%
Frequency change with voltage	$V_{CC}=7\text{V to } 40\text{V}, T_a=25^\circ\text{C}$		10	%
Frequency change with temperature	$C_T=0.01\mu\text{F}, R_T=12\text{k}\Omega,$		2	

## PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

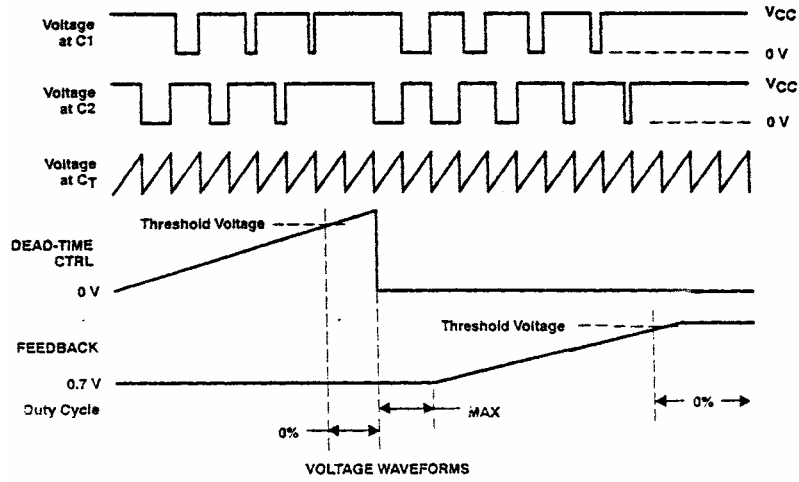


Figure 1. Operational Test Circuit and Waveforms

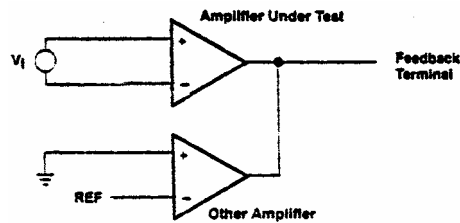


Figure 2. Amplifier Characteristics

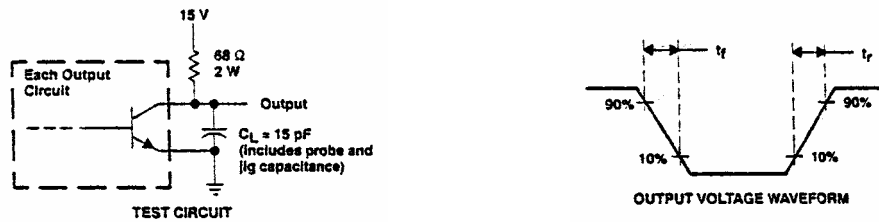


Figure 3. Common-Emitter Configuration

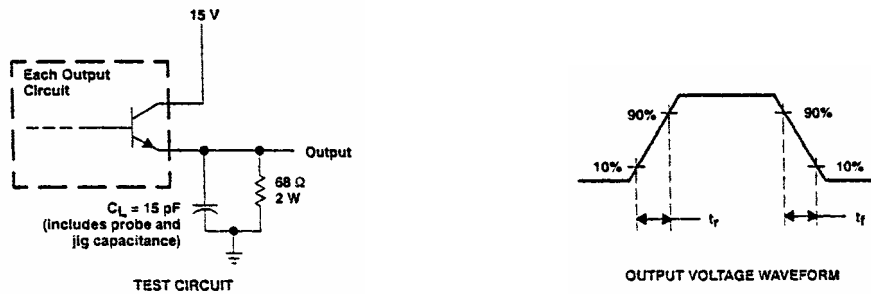


Figure 4. Emitter-Follower Configuration

**TYPICAL CHARACTERISTICS**  
**OSCILLATOR FREQUENCY AND FREQUENCY VARIATION**  
**VS**  
**TIMING RESISTANCE**

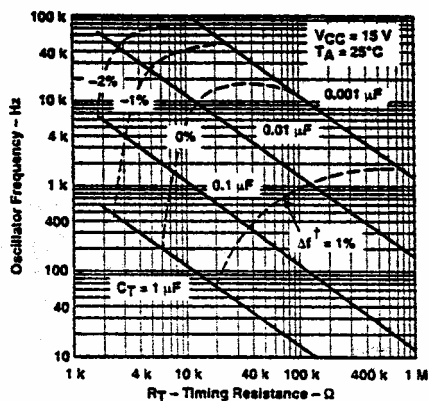


Figure 5

**AMPLIFIER VOLTAGE AMPLIFICATION vs FREQUENCY**

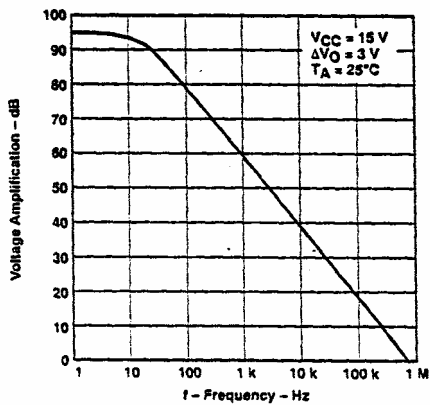
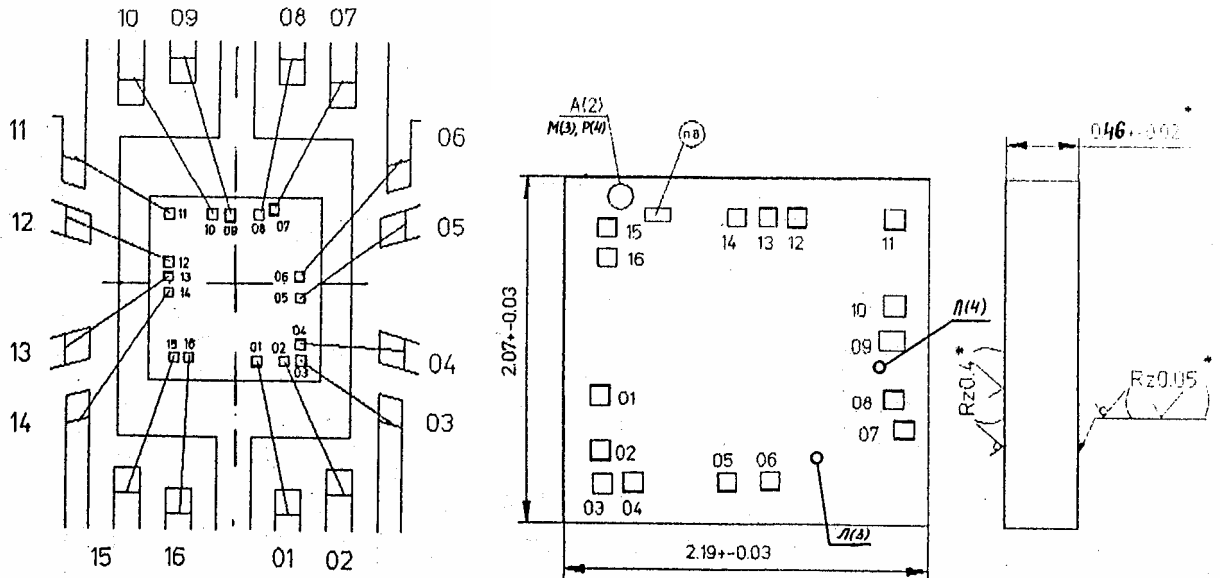


Figure 6



# of pad	Co-ordinates (left lower corner) mm		Pad size
	X	Y	
01	0.101	0.714	0.115x0.120
02	0.104	0.383	0.115x0.119
03	0.177	0.177	0.117x0.125
04	0.362	0.189	0.110x0.110
05	0.932	0.199	0.10x0.111
06	1.100	0.208	0.111x0.111
07	1.983	0.523	0.123x0.108
08	1.921	0.704	0.120x0.111
09	1.893	1.047	0.154x0.115
10	1.920	1.253	0.129x0.120
11	1.923	1.768	0.122x0.121
12	1.342	1.776	0.112x0.117
13	1.173	1.780	0.102x0.112
14	0.983	1.781	0.107x0.106
15	0.200	1.709	0.111x0.111
16	0.201	1.534	0.114x0.109