

VOLTAGE MODE PWM CONTROL CIRCUITS

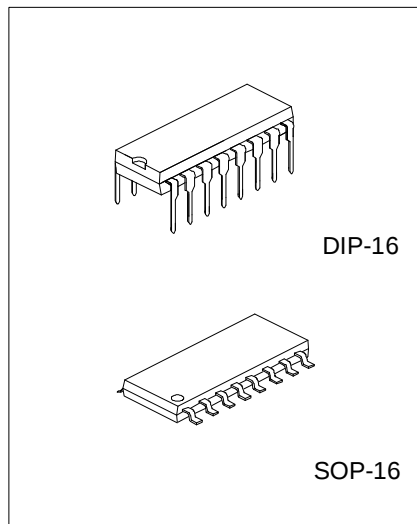
DESCRIPTION

The UTC494 incorporate on a single monolithic chip all the functions required in the construction of a pulse-width modulation control circuit. Designed primarily for power supply control, the device offers the systems engineer the flexibility to tailor the power supply control circuitry to its application.

The UTC494 contains an error amplifier, current-limiting amplifier, an on-chip adjustable oscillator, a dead time control comparator, pulse-steering control flip-flop, a 5-volt, 1% precision supply regulator, and output control circuits.

The error amplifier exhibits a common-mode Voltage range from -0.3V to $V_{CC}-2V$. The current-limit amplifier exhibits a common-mode Voltage range from -0.3V to 3V with an offset Voltage of approximately 80 mV in series with the inverting input to ease circuit design requirements. The dead-time control comparator has a fixed offset that provides approximately 5% dead time when externally altered. The on-chip oscillator may be bypassed by terminating R_T (pin 6) to the reference output and providing a sawtooth Input to C_T (pin 5), or it may be used to drive the common circuits in synchronous multiple-rail power supplies.

The Uncommitted output transistors provide either common-emitter or emitter-follower output capability. Each device provides for push-pull or single-ended output operation, which may be selected through the output-control function. The architecture of these devices prohibits the possibility of either being pulsed twice during push-pull operation.



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 control Over Total Range
- *Circuit architecture Allows easy Synchron - ization
- *Undervoltage Lockout

ABSOLUTE MAXIMUM RATINGS

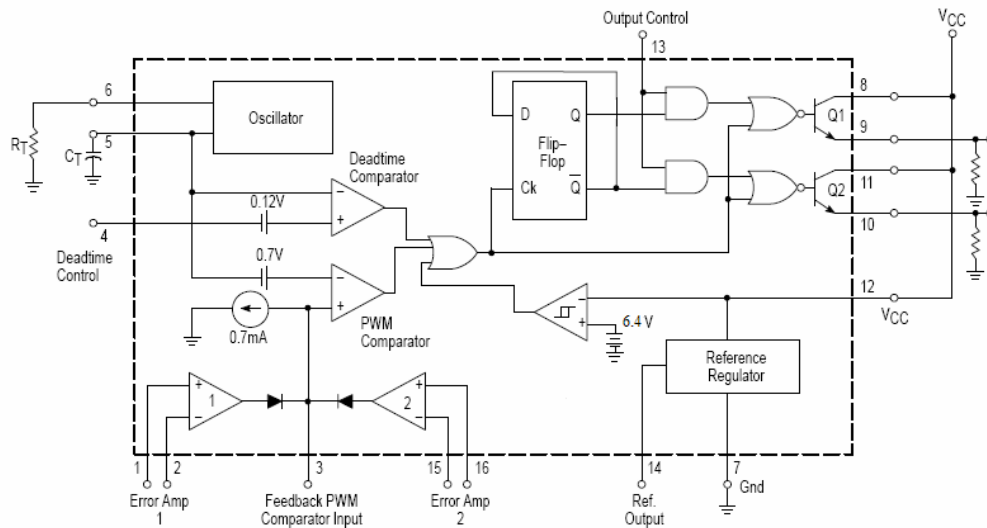
(Unless otherwise noted, all is over operating free-air temperature Range)

Characteristic	Symbol	Value	Unit
Supply Voltage(note 1)	V_{CC}	40	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_{stg}	-65 to 150	°C
Lead Temperature 1.6mm from case for 60 sec.	T_{case}	300	°C

note1: 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.

BLOCK DIAGRAM



This device contains 46 active transistors.

RECOMMENDED OPERATING CONDITIONS

Characteristic	Symbol	Values		Unit
		min	max	
Supply Voltage	Vcc	7	36	V
Amplifier Input Voltage	Vi	-0.3	Vcc-2	V
Collector Output Voltage	Vo		40	V
Collector Output Current(each Transistor)	Ic		200	mA
Current into feedback	If		0.3	mA
Timing capacitor	CT	0.47	10000	nF
Timing Resistor	RT	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, Vcc=15V, f=1kHz, Unless otherwise specified)

Characteristic		Test Conditions	Min	Typ	Max	Unit
Reference Section						
Output voltage		I _o =1mA	4.9	5	5.1	V
Input regulation		V _{cc} =7V to 36V		2	25	mV
Output Regulation		I _o =1 to 10mA		1	15	mV
Output Voltage change with Temperature		ΔT _A =MIN to MAX(note 2)		0.2	1	%
Short-circuit output Current		V _{ref} =0		35		mA
Characteristic		Test Conditions	Min	Typ	Max	Unit
Oscillator section						
Frequency		C _T =0.01μF, R _T =120kΩ		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 to 36V, T _A =25°C		0.1		%
Frequency Change with temperature		C _T =0.01μF, R _T =12kΩ, ΔT _A =MIN to MAX			12	%
Amplifier Section						
Input offset Voltage		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		V _{cc} =7V to 36 V	-0.3		V _{cc} -2	V
Open-Loop Voltage Amplification		ΔV _o =3V, V _o =0.5V to 3.5V	70	95		dB
Unity-Gain Bandwidth				800		kHz
Common-Mode Rejection ratio		V _{cc} =36V, T _A =25°C	65	80		dB
output sink current(pin 3)		V _{ID} =-15mV to -5V V(pin 3)=0.5V	0.3	0.7		mA
Output source Current(pin 3)		V _{ID} =15mV to 5V V(pin 3)=3.5V	-2			mA
Output Section						
Collector off-state current		V _{CE} =40V, V _{cc} =36V		2	100	μA
Emitter off-state Current		V _{CC} =V _C =36V, 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 _i =V _{ref}			3.5	mA
Dead Time Control Section						
Input bias (pin 4)		V _i =0 to 5.25V		-2	-10	μA
Maximum duty cycle, each output		V _I (pin 4)=0	45			%
Input threshold Voltage(pin 4)		Zero duty Cycle		3	3.3	V
		Maximum duty cycle	0			
PWM comparator Section						
Input Threshold Voltage(pin 3)		Zero Duty cycle		4	4.5	V
Input sink current (pin 3)		V _{pin 3} = 0.7V	0.3	0.7		mA
Total Device						
Standby supply current		V _{cc} =15V pin 6 at V _{ref} , all other Inputs and outputs open		6	10	mA

	Vcc=40V		9	15	
Average supply current	Vpin 4=2V		7.5		mA
Switching Characteristics, Ta=25°C					
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.

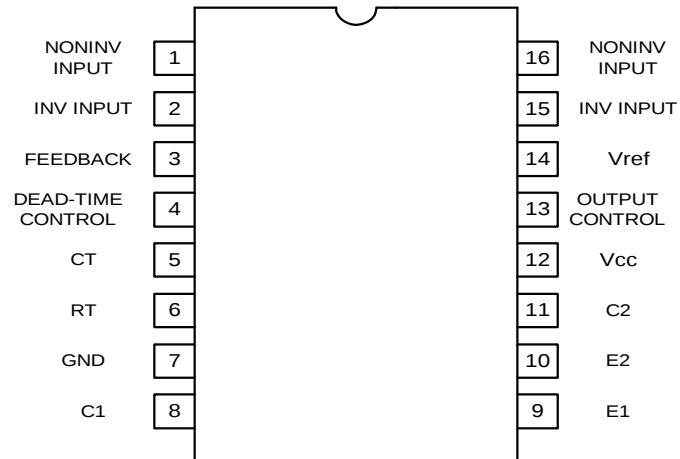
note 2: For conditions shown as MIN or MAX, use appropriate value under recommended operating conditions.

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

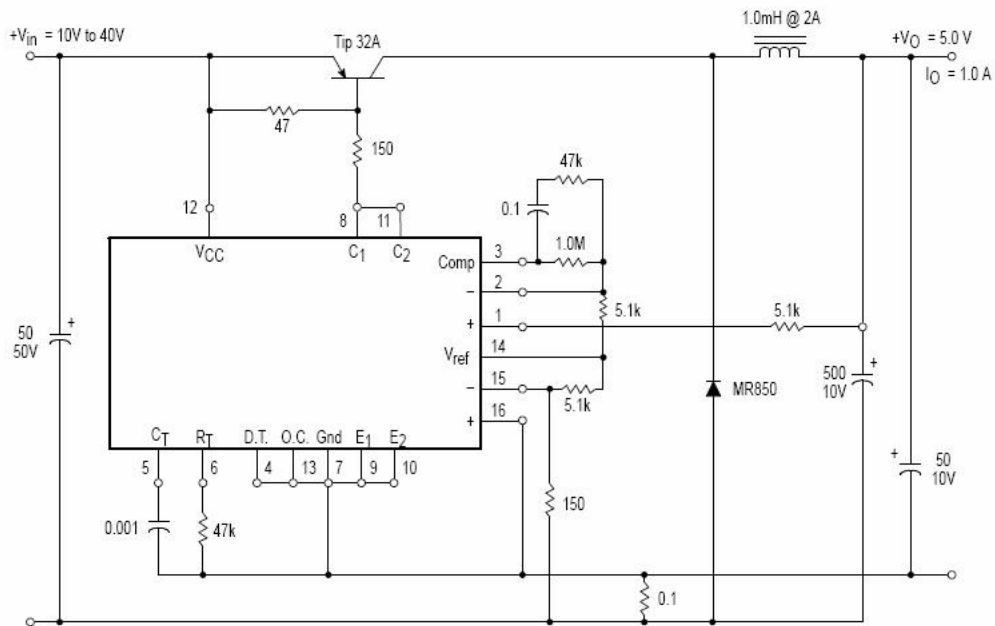
note 4: Standard deviation is a measure of the statistical distribution the mean as derived from the formula :

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

PIN CONFIGURATIONS



TYPICAL APPLICATION CIRCUIT



TEST CIRCUIT

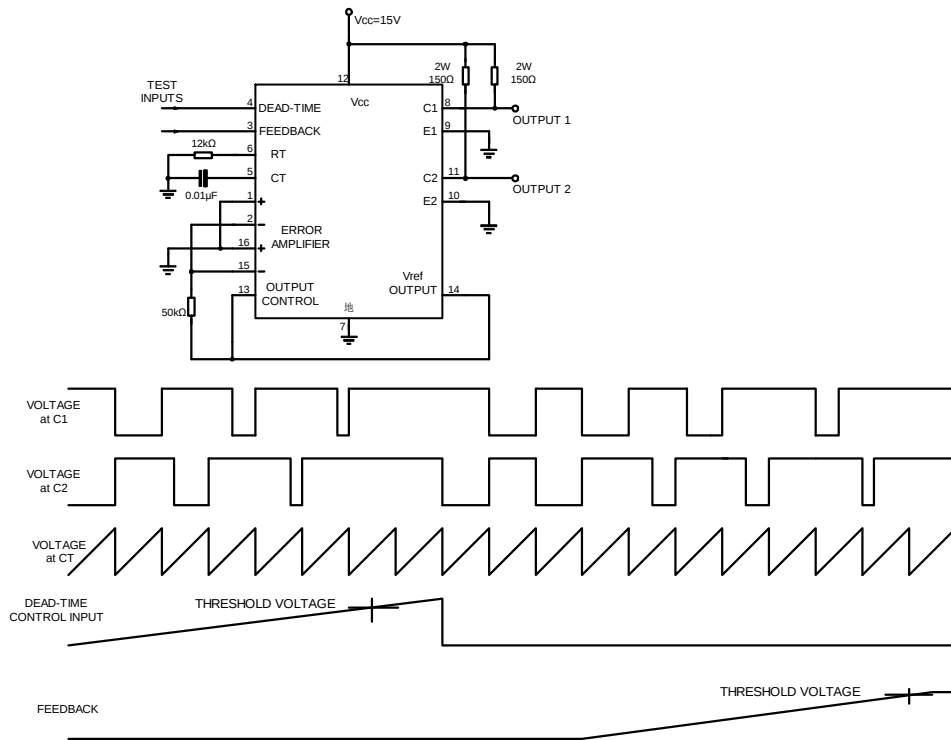


FIG 1. OPERATIONAL TEST CIRCUIT AND WAVEFORMS

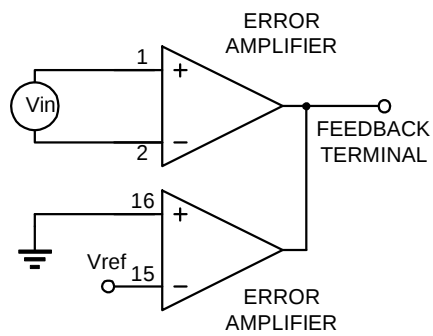


FIG 2. AMPLIFIER CHARACTERISTICS

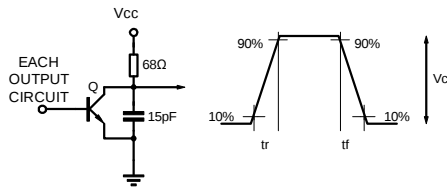


FIG. 3 COMMON-EMITTER CONFIGURATION

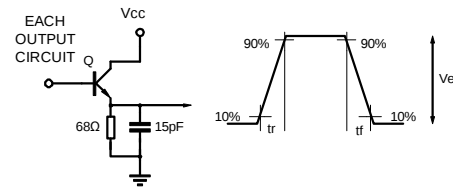


FIG. 4 EMITTER -FOLLOWER CONFIGURATION

TYPICAL PERFORMANCE CHARACTERISTICS

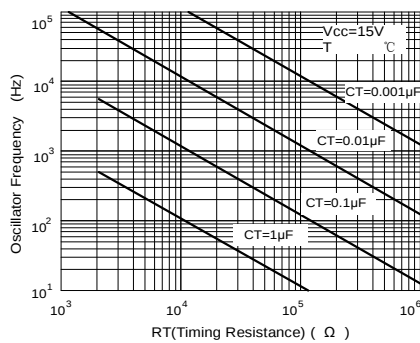
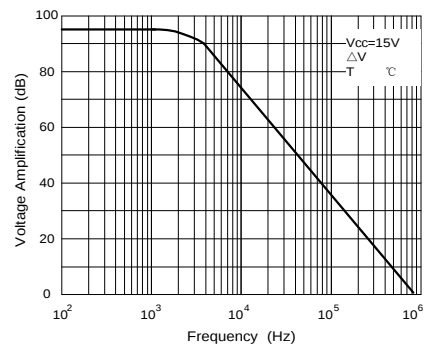
FIG 5. Oscillator Frequency and Frequency Variation
Vs
Timing Resistance

Fig.6 Amplifier Voltage Amplification

UTC494

LINEAR INTEGRATED CIRCUIT

PACKAGE DIMENSIONS

