HT494

DOS Electronics Pte Ltd

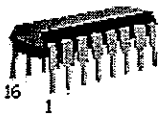
SWITCHMODE PULSE WIDTH MODULATIONCONTROL CIRCUIT

Description

The HT494 is a fixed frequency, pulse width modulation control circuit designed primarily for SWITCHMODE power supply Control

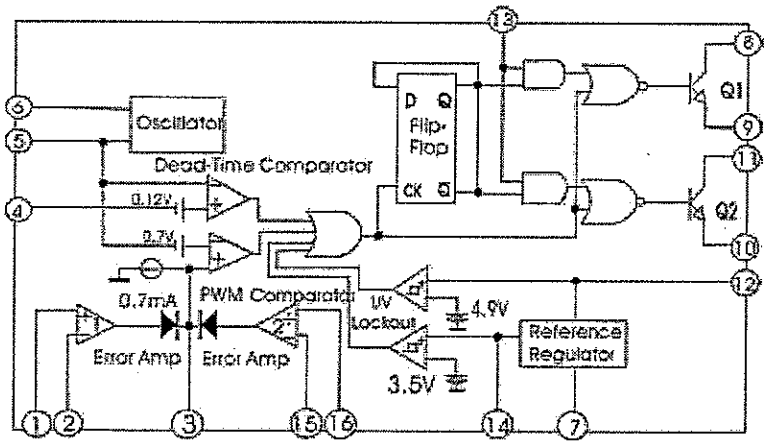
Feature

- Complete Pulse Width Modulation Control Circuitry
- On-Chip Oscillator with Master or Slave Operation
- On-Chip Error Amplifier
- On-Chip 5.0V Reference
- Adjustable Dead-Time Control
- Uncommitted Output Transistors Rated to 500mA Source or Sink
- Output Control for Push-Pull or Single-Ended Operation
- Under-voltage Lockout

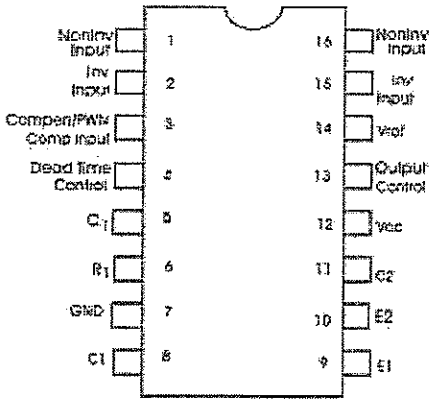


16DIP

Block Diagram



Pin Connection



Absolute Maximum Ratings (Ta=25°C)

Characteristic	*Symbol*	*Value*	*Unit*
Power Supply Voltage	Vcc	42	V
Collector Output Voltage Vc1	Vc1; Vc2	42	V
Collector Output Current (Each transistor) (Note)	Ic1; Ic2	250	mA
Amplifier Input Voltage Range	V_{IR}	-0.3~42	V
Power Dissipation (Tamb≤45°C)	P_D	1000	mW
Operating Junction Temperature	T_J	150	°C
Operating Temperature Range	Tamb	-25~85	°C
Storage Temperature	Tstg	-65~150	°C

Note: Maximum thermal limits must be observed

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Recommended Operating Conditions

Characteristics	*Symbol*	*Min.*	*Typ.*	*Max.*	*Unit*
Power Supply Voltage	Vcc	7.0	15	40	V
Collector Output Voltage	Vc1; Vc2		30	40	V
Collector Output Current (Each transistor)	Ic1;Ic2			200	mA
Amplifier Input Voltage	Vin	-0.3		Vcc-2.0	V
Current Into Feedback Terminal	Ifb			0.3	mA
Reference Output Current	Iref			10	mA
Timing Resistor	R_T	1.8	30	500	kΩ
Timing Capacitor	C_T	0.00047	0.001	10	μF
Oscillator Frequency	fosc	1.0	40	200	kHz

Electrical Characteristics

(unless otherwise specified: Vcc=15V,R_T=12kΩ, C_T=0.01 μF, For typical values Tamb=25℃, for min/max is the operating ambient temperature range that applies.)

Characteristics	*Test conditions*	*Symbol*	*Min.*	*Typ.*	*Max.*	*Unit*
Reference Section•						
Reference Voltage	Io=1.0mA	Vref	4.9	5.0	5.1	V
Line Regulation	Vcc=7.0V~40V	Reg_{line}		2.0	25	mV
Load Regulation	Io=1.0mA~10mA	Reg_{load}		3.0	15	mV
Short Circuit Output Current	Vref=0V,Tamb=25℃	Isc		30		mA
Output Section•						
Collector Off-State Current	Vcc=40V;Vce=40V	Ic(off)		2.0	100	μA
Emitter Off-State Current	Vcc=40V;Vc=40V; Ve=0V	Ie(off)			-100	μA
Collector-Emitter Saturation Voltage	Common-Emitter: Ve=0V;Ic=200mA	Vc(sat)		1.1	1.3	V
	Emitter-Follow: Vc=15V;Ie=-200mA	Ve(sat)		1.5	2.5	V
Output Control Pin Current	Low state: Voc≤0.4V	I_{OCL}		10		μA
	High state: Voc=Vref	I_{OCH}		0.2	3.5	mA
Output Voltage Rise Time	Common-Emitter (see test circuit 3)	Tr		100	200	ns
	Emitter-Follower (see test circuit 4)			100	200	ns
Output Voltage Fall Time	Common-Emitter (see test circuit 3)	Tf		25	100	ns
	Emitter-Follower (see test circuit 4)			40	100	ns

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Electrical Characteristics (continue)

Characteristics	*Test conditions*	*Symbol*	*Min.*	*Typ.*	*Max.*	*Unit*
PWM Comparator Section						
Input Threshold Voltage	Zero Duty Cycle	V_{TH}		3.5	4.5	V
Input Sink Current	V (pin3) =0.7V	I_I-	0.3	0.7		mA
Dead-Time Control Section						
Input Bias Current (pin 4)	V(pin 4)=0V~5.25V	$I_{IB(DT)}$		-2.0	-10	μ A
Maximum Duty Cycle, Each Output, Push-Pull Mode	V(pin4)=0V; RT=12kΩ ; CT=0.1 μ F	DC max	45	48	50	%
	V(pin4)=0V;RT=30kΩ CT=0.001 μ F			45	50	
Input Threshold Voltage (pin4)	Zero Duty Cycle	V_{TH}		2.8	3.3	V
	Maximum Duty Cycle•					
Error Amplifier Section•						
Input Offset Voltage	Vo (pin3) =2.5V	Vio		2.0	10	mV
Input Offset Current	Vo (pin3) =2.5V	Iio		5.0	250	nA
Input Bias Current	Vo (pin3) =2.5V	I_{IB}		0.1	1.0	μ A
Input Common Mode Voltage Range	Vcc=7.0V~40V	V_{ICR}	-0.3		Vcc-2	V
Open-Loop Voltage Gain	Vo=0.5V~3.5V; RL=2.0kΩ ; △Vo=3.0V	G_{VOL}	70	95		dB
Unity-Gain Crossover Frequency	Vo=0.5V~3.5V; R_L=2.0kΩ	fc		350		kHz
Phase Margin at Unity-Gain	Vo=0.5V~3.5V; R_L =2.0kΩ	θ m		65		deg
Common Mode Rejection Ratio	Vcc=40V	CMRR	65	90		dB
Power Supply Rejection Ratio	Vo=2.5V; R_L=2.0kΩ Δ Vcc=33V	PSRR		100		dB
Output Sink Current	Vo (pin3) =0.7V	Io-	0.3	0.7		mA
Output Source Current	Vo (pin3) =3.5V	Io+	-2.0	-4.0		mA
Oscillator Section•						
Frequency	R_T=30kΩ ; C_T=0.001 μ F	fosc		40		
Standard Deviation of Frequency	R_T=30kΩ ; C_T=0.001 μ F	Δ fosc		3.0		
Frequency Change with Voltage	Vcc=7.0V~40V	Δ fosc/ Δ V		0.1		
Frequency Change with Temperature	R_T=12kΩ ; C_T=0.01 μ F; Tamb=Tlow~Thigh	Δ fosc/ Δ T			12	
Under-Voltage Lockout Section						
Turn-on Threshold	Vcc increasing, Iref=1mA	V_{TH}	5.5	6.43	7.0	V
Total Device						
Standby Supply Current (pin6 at Vref, all other inputs and outputs open)	Vcc=15V	Icc		5.5	10	mA
	Vcc=40V			7.0	15	
Average Supply Current (test circuit 2)	Vcc=15V; R_T=12kΩ ; C_T=0.01 μ F;V(pin14)=2.0V			7.0		mA

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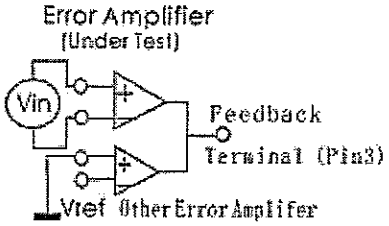
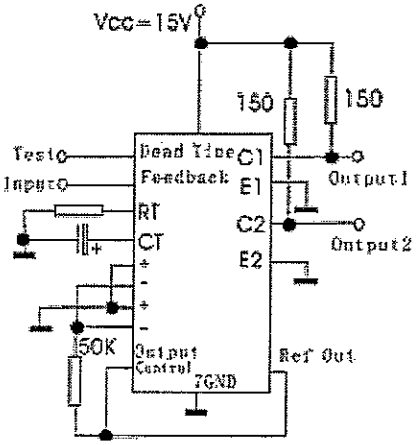
Test Circuit

1. Error-Amplifier Characteristic

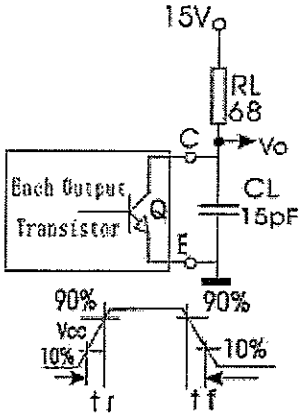


2.Dead-Time and Feedback Control Circuit



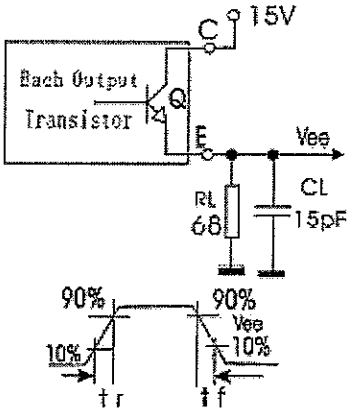
3. Common-Emitter Configuration

Test Circuit and waveform

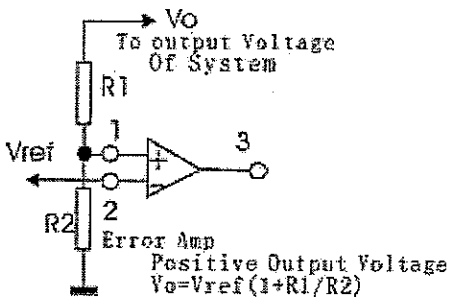


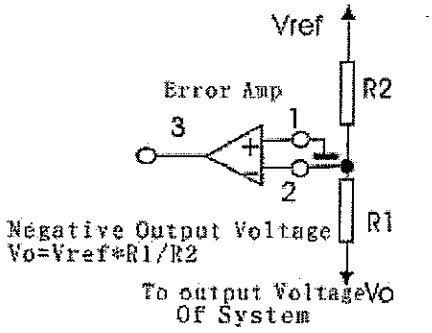
4. Emitter-Follow Configuration

Test Circuit and waveform



5.Error-Amplifier Sensing Techniques





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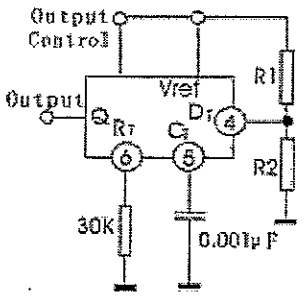
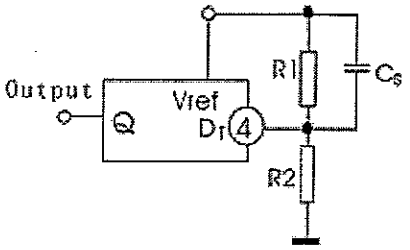
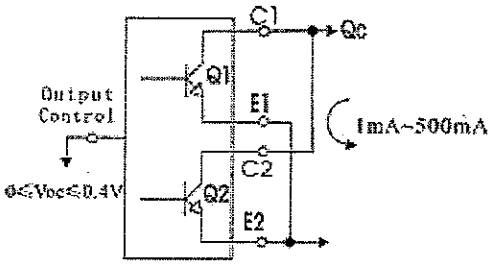
6.Dead-Time Control Circuit

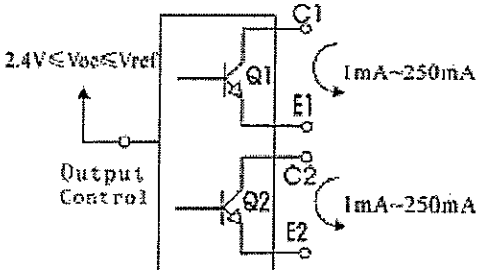


7.Soft-start Circuit•

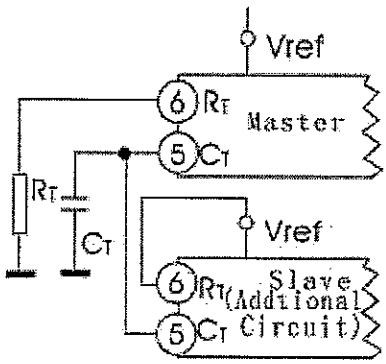


8.Output Connections for Single-Ended and Push-Pull Configuration•





9.Slaving Two or More Control Circuit•



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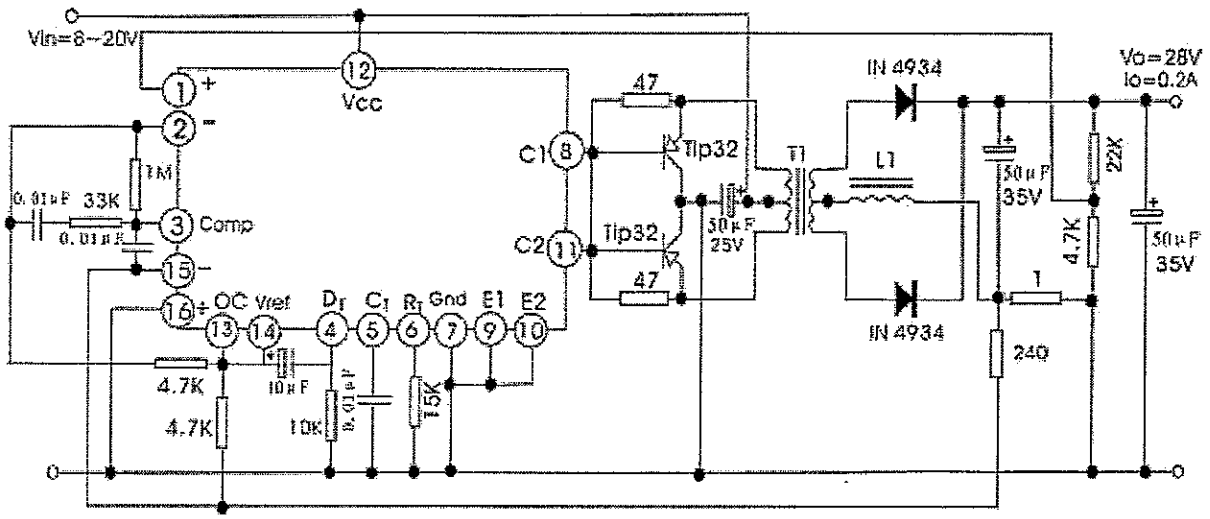
10.Pulse Width Modulated Push-Pull Converter•



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Line Regulation	Vin=10V~40V	14mV 0.28%
Load Regulation	Vin=28V; Io=1.0mA~1.0A	3.0Mv 0.06%
Output Ripple	Vin=28V; Io=1.0A	65mVpp P.A.R.D
Short Circuit Current	Vin=28V; R_L=0.1Ω	1.6A
Efficiency	Vin=28V; Io=1.0A	71%

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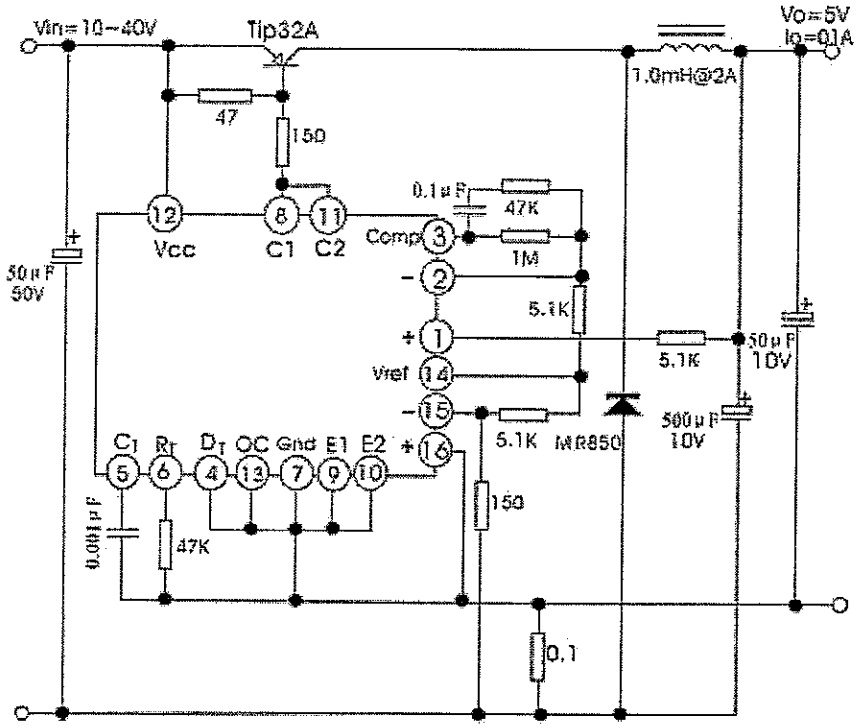
11.Pulse Width Modulated Step-Down Converter•



•••••	••••••••••	••••••••
Line Regulation	Vin=8V~40V	3.0mV 0.01%
Load Regulation	Vin=12.6V; Io=0.2mA~200mA	5.0mV 0.02%
Output Ripple	Vin=12.6V; Io=200mA	40mVpp P.A.R.D
Short Circuit Current	Vin=12.6V; R_L=0.1Ω	250mA
Efficiency	Vin=12.6V; Io=200mA	721%

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