



虹冠電子工業股份有限公司  
Champion Microelectronic Corporation

*Specialized in Integrated High Efficient Switching Power Management Solutions*  
高整合高效率交換型電源管理方案之專業 I C 設計



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## GENERAL DESCRIPTION

This of PWM modulator provides a complete pulse width modulation system in a single monolithic integrated circuit. This device includes a 5V reference accurate to  $\pm 1\%$ , two independent amplifiers usable for both voltage and current sensing, an externally synchronizable oscillator with its linear ramp generator, and two-uncommitted transistor output switches. These two outputs may be operated either in parallel for single-ended operation or alternating for push-pull applications with an externally controlled dead-band. This unit is internally protected against double-pulsing of a single output or from extraneous output signals when the input supply voltage is below minimum.

The CM494 contains an on-chip 39V zener diode for high-voltage applications where  $V_{cc}$  would be greater than 40V, and a buffered output steering control that overrides the internal control of the pulse steering flip-flop.

## FEATURES

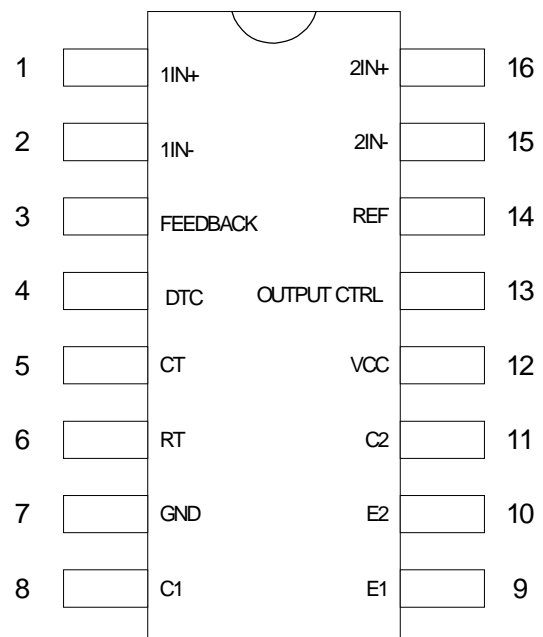
- ◆ Dual uncommitted 40V, 200mA output transistors.
- ◆ 1% accurate 5V reference.
- ◆ Dual error amplifiers.
- ◆ Wide range, variable dead time.
- ◆ Single-ended or push-pull operation.
- ◆ Under-voltage lockout with hysteresis.
- ◆ Double pulse protection.
- ◆ Master or slave oscillator operation.

## APPLICATIONS

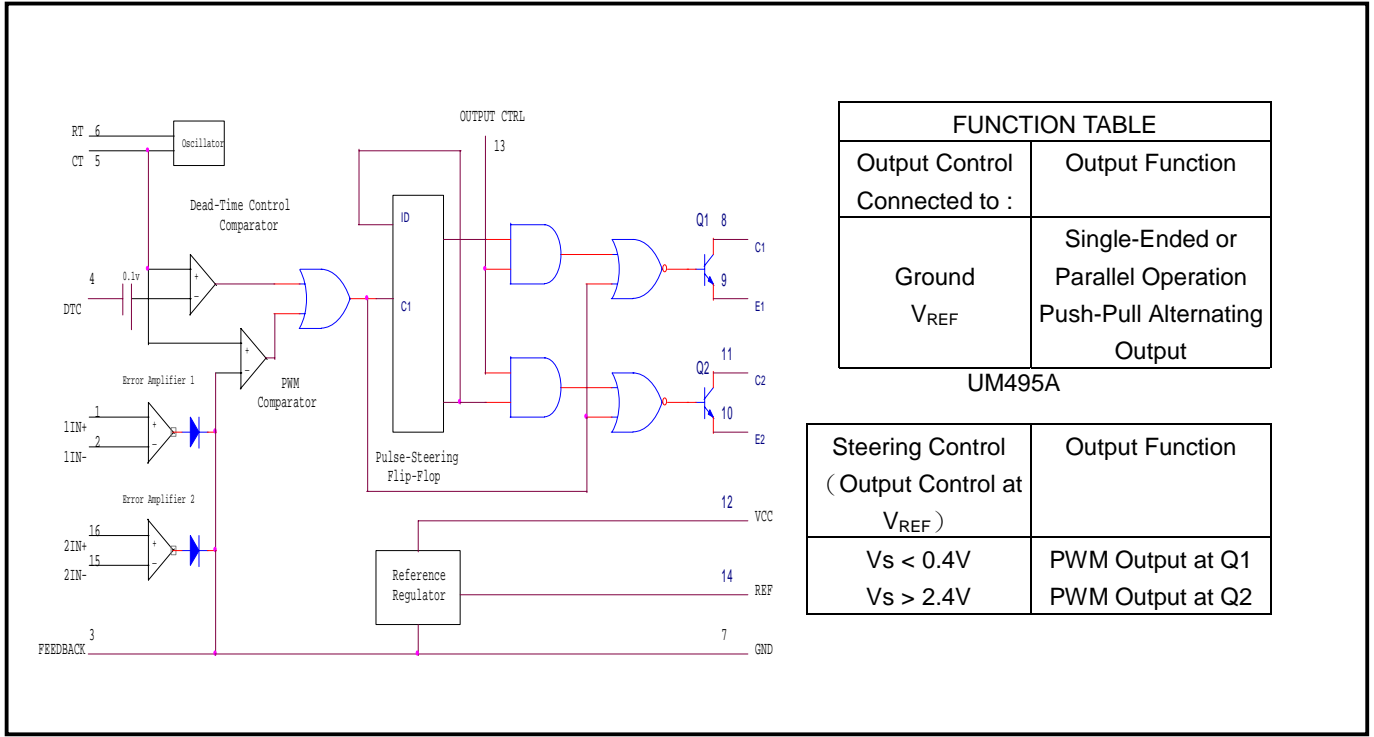
- ◆ Linear Regulators
- ◆ Adjustable Supplies
- ◆ Switching Power Supplies
- ◆ Battery Operated Computers
- ◆ Instrumentation
- ◆ Computer Disk Drives

## PIN CONFIGURATION

16-PIN PDIP/SOP  
(Top View)



### BLOCK DIAGRAM



### ORDERING INFORMATION

Part Number	Temperature Range	Package
CM494CP	0°C to 70°C	16-PIN DPIP (P16)
CM494CS	0°C to 70°C	16-PIN SOP (S16)

### ABSOLUTE MAXIMUM RATINGS

Supply voltage, $V_{CC}$ (Note 2).....	45V
Amplifier input voltages.....	$V_{CC} + 0.3V$
Collector output voltage.....	41V
Collector output current.....	250mA
Continuous total dissipation.....	1000mW
@ (or below) 25°C free air temperature range (Note 3)	
Storage temperature range.....	-65°C to + 150°C
Lead temperature 1 / 16"(1.6mm) from case for 60 seconds, J package.....	300°C
Lead temperature 1 / 16"(1.6mm) from case for 10 seconds, N package.....	260°C

Note 1: Over operating free air temperature range unless otherwise noted.

Note 2: All voltage values are with respect to network ground terminal 3.

Note 3: Consult package section of data book regarding thermal specification and limitation of package.

### RECOMMENDED OPERATING CONDITION

Supply voltage $V_{CC}$ .....	7V to 40V
Error amplifier input voltages.....	-0.3 to $V_{CC}-2V$
Collector output voltage.....	.40V
Collector output current (each transistor)...	200mA
Current into feedback terminal.....	0.3mA
Timing capacitor, $C_T$ ...	0.47nF to 10,000nF
Timing resistor, $R_T$ .....	1.8k $\Omega$ to 500k $\Omega$
Oscillator Frequency.....	1kHz to 300kHz
Operating free air temperature	
UC494A, UC495A.....	-55°C to + 125°C
UC494AC, UC495AC.....	0°C to +70°C

**ELECTRICAL CHARACTERISTICS:** Unless otherwise stated, over recommended operating free-air temperature range.  $V_{CC} = 15V$ ,  $f = 10KHz$ ,  $T_A = T_J$ .

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
<b>Reference Section</b>					
Output voltage $V_{REF}$	$I_o = 1mA$ , $T_A = 25^\circ C$	4.75	5	5.25	V
Input regulation	$V_{CC} = 7V$ to $40V$		2	25	mV
Output regulation	$I_o = 1mA$ to $10mA$		1	15	mV
Output voltage over temperature	$\Delta T_A = \text{Min. to Max}$	4.90		5.10	V
Short circuit output current	$V_{REF} = 0$ , $T_A = 25^\circ C$	10	35	50	mA
<b>Oscillator Section</b>					
Frequency (Note 2)	$C_T = 0.01\mu F$ , $R_T = 12\Omega$		10		kHz
Standard deviation of frequency (Note 3)	All values of $V_{CC}$ , $C_T$ , $R_T$ , $T_A$		10		%
Frequency change with voltage	$V_{CC} = 7V$ to $40V$ , $T_A = 25^\circ C$		0.1		%
Frequency change with temperature	$C_T = 0.01\mu F$ , $R_T = 12k\Omega$ , $\Delta T_A = \text{Min. to Max}$			2	%
<b>Deadtime Control Section</b> (Output control connected to $V_{REF}$ )					
Input bias current (Pin 4)	$V_{(PIN 4)} = 0V$ to $5.25V$		-2	-10	$\mu A$
Maximum duty-cycle (each output)	$V_{(PIN 4)} = 0V$	45			%
<b>Deadtime control Section (cont.)</b> (Output control connected to $V_{REF}$ )					
Input threshold voltage (Pin 4)	Zero duty-cycle		3	3.3	V
	Maximum duty-cycle	0			V
<b>Amplifier Section</b>					
Input offset voltage	$V_O (PIN 3) = 2.5V$		2	10	mV
Input offset current	$V_O (PIN 3) = 2.5V$		25	250	nA
Input bias current	$V_O (PIN 3) = 2.5V$		-0.2	-1	$\mu A$
Common-mode input voltage range	$V_{CC} = 7V$ to $40V$	.03 to $V_{CC} - 2$			V
Open loop voltage gain	$\Delta V_o = 3V$ , $V_o = 0.5V$ to $3.5V$	70	95		dB
Unity gain bandwidth			800		kHz
Common-mode rejection ratio	$V_{CC} = 40V$ , $T_A = 25^\circ C$	65	80		dB
Output sink current (Pin 3)	$V_{ID} = -15mV$ to $-5V$ , $V_{(PIN 3)} = 3.5V$	0.3	0.7		mA
Output Source current (Pin 3)	$V_{ID} = -15mV$ to $5V$ , $V_{(PIN 3)} = 3.5V$	-2			mA

**ELECTRICAL CHARACTERISTICS:** Unless otherwise stated, over recommended operating free-air temperature range.  $V_{CC} = 15V$ ,  $f = 10KHz$ ,  $T_A = T_J$ 

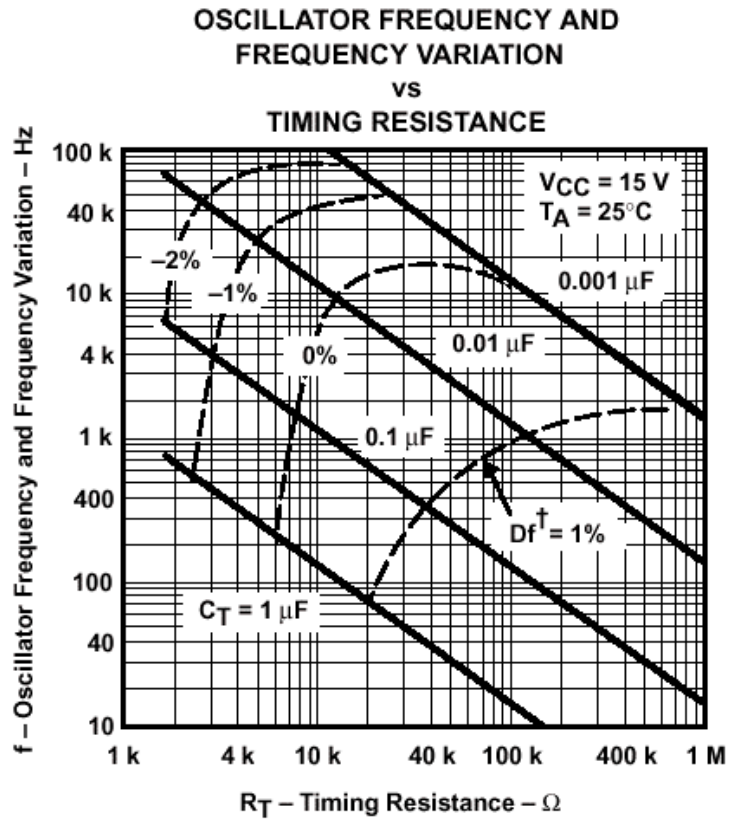
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS	
<b>Output Section</b>						
Collector off-state current	$V_{CE} = 40V, V_{CC} = 40V$		2	100	$\mu A$	
Emitter off-state current	$V_{CC} = V_C = 40V, V_E = 0$			-100	$\mu A$	
Collector-Emitter Saturation voltage	Common-Emitter $V_E = 0, I_C = 200mA$		1.1	1.3	V	
	Emitter-follower $V_C = 15V, I_E = -200mA$		1.5	2.5	V	
Output control input current	$V_I = V_{REF}$			3.5	mA	
<b>PWM Comparator Section</b>						
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	
<b>Steering Control</b>						
Input current	$V_{(Pin 13)} = 0.4V, Q_1 \text{ ACTIVE}$			-200	$\mu A$	
	$V_{(Pin 13)} = 2.4V, Q_2 \text{ ACTIVE}$			300	$\mu A$	
Deadband			500		mA	
<b>Zener Diode Circuit (UC495A)</b>						
Breakdown voltage	$V_{CC} = 45V, I_Z = 2mA$	36	39	.45	V	
Sink current	$V_{(Pin 15)} = 1V$	0.2	0.3	0.6	mA	
<b>Total Device</b>						
Standby supply current	Pin 6 at $V_{REF}$ , All other inputs and outputs open	$V_{CC} = 15V$		6	10	mA
		$V_{CC} = 40V$		9	15	mA
Under voltage lockout		3.5		6.5	V	
Hysteresis			300		mV	
<b>Switching Characteristics (<math>T_A = 25^\circ C</math>)</b>						
Output voltage rise time	Common-emitter configuration		100	200	ns	
Output voltage fall time	$R_L = 68\Omega, C_L = 15pF$		25	100	ns	
Output voltage rise time	Emitter-follower configuration		100	200	ns	
Output voltage fall time	$R_L = 68\Omega, C_L = 15pF$		40	100	ns	

Note 1: Duration of the short circuit should not exceed one second.

Note 2: Frequency for other values of  $C_T$  and  $R_T$  is approximately  $f = 1.1/RTCT$

Note 3: Standard deviation is measure of the statistical distribution about the mean as derived from the formula:

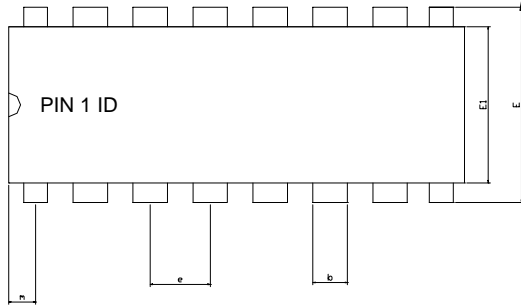
$$\sigma = \sqrt{\frac{\sum_{n=1}^n (X_n - X)^2}{n-1}}$$

**TYPICAL CHARACTERISTICS**


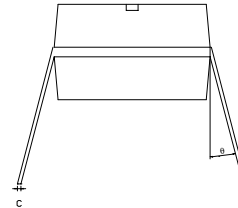
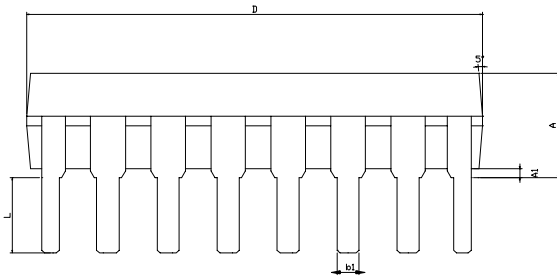
Frequency variation ( $\Delta f$ ) is the change in oscillator frequency that occurs over the full temperature range.

### PACKAGE DIMENSION

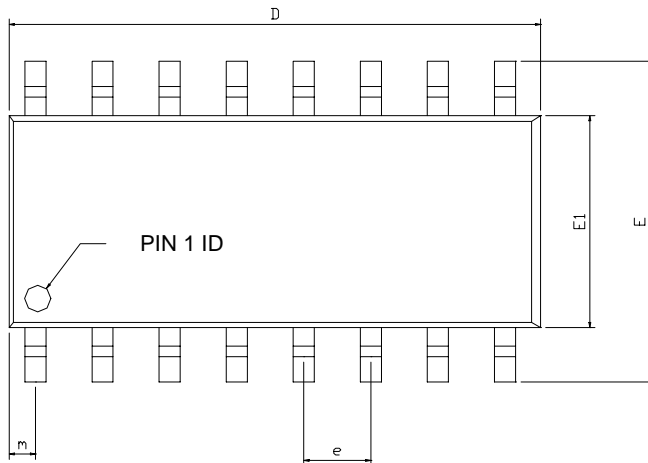
#### 16-PIN PDIP (P16)



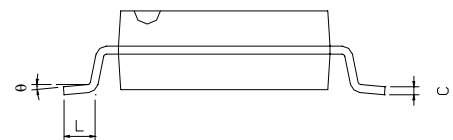
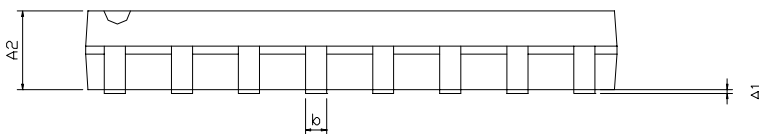
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	4.32	---	---	0.170
A1	0.38	---	---	0.015	---	---
b	1.40	---	1.65	0.055	---	0.065
b1	0.40	---	0.56	0.016	---	0.022
C	0.20	---	0.31	0.008	---	0.012
D	18.79	---	19.31	0.740	---	0.760
E	7.49	---	8.26	0.295	---	0.325
E1	6.09	---	6.61	0.240	---	0.260
e	---	2.54	---	---	0.100	---
L	3.18	---	---	0.125	---	---
m	0.50	---	---	0.02	---	---
θ	0°	---	15°	0°	---	15°



#### 16-PIN SOP (S16)



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHS		
	MIN	NOM	MAX	MIN	NOM	MAX
A1	0.05	---	0.15	0.002	---	0.006
A2	1.40	---	1.55	0.055	---	0.061
b	0.30	---	0.51	0.012	---	0.020
C	0.15	---	0.26	0.006	---	0.010
D	9.80	---	10.06	0.386	---	0.396
E	5.79	---	6.20	0.228	---	0.244
E1	3.76	---	4.01	0.148	---	0.158
e	---	1.27	---	---	0.050	---
L	0.38	---	0.69	0.015	---	0.035
m	0.43	---	0.69	0.017	---	0.027
θ	0	---	8	0	---	8





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