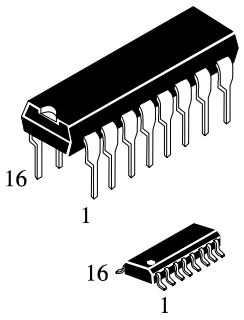
PWM Control Circuit

KK494

The KKK494 incorporates 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 KK494 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 KK494 prohibits the possibility of either output being pulsed twice during push-pull operation.

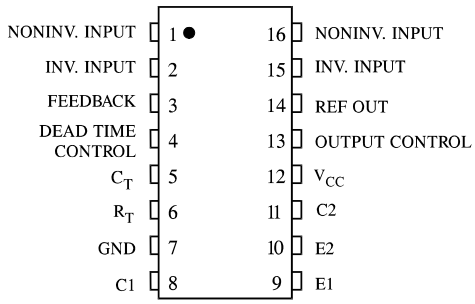
- Complete PWM Power Control Circuitry
- Uncommitted Outputs for 200 mA Sink or Source
- Output Control Selects Single-Ended or Push-Pull Operation
- Internal Circuitry Prohibits Double Pulse at Either Output
- Internal Regulator Provides a Stable 5 V Reference Supply
- Variable Dead-Time Provides Control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



ORDERING INFORMATION

KK494N Plastic
KK494D SOIC
T_A = -20°C to 85° C for all packages

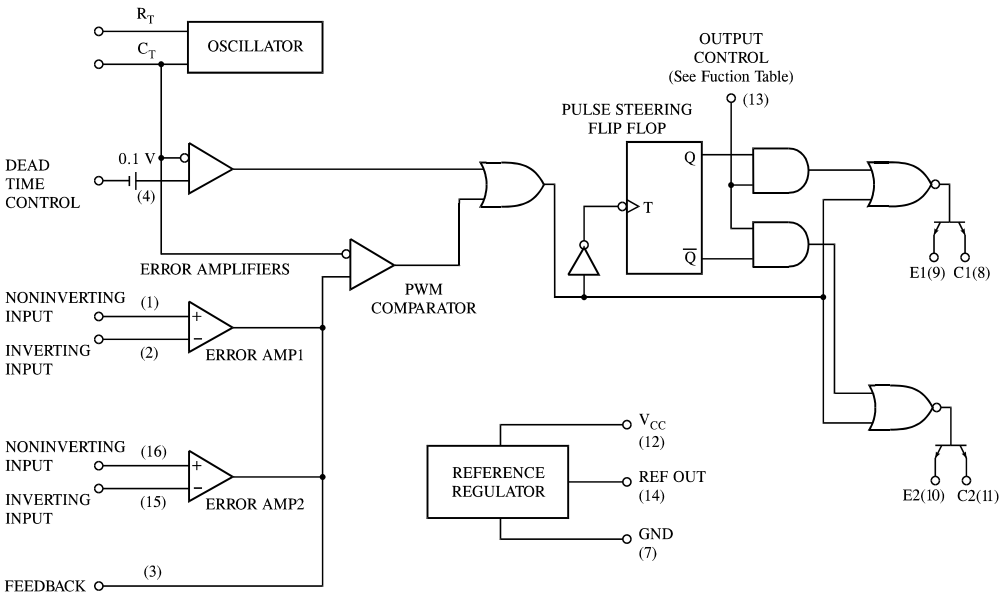
PIN ASSIGNMENT



FUNCTION TABLE

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

LOGIC DIAGRAM



MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	41	V
V_I	Amplifier Input Voltage	V_{CC} +0.3	V
V_O	Collector Output Voltage	41	V
	Collector Output Current	250	mA
Tstg	Storage Temperature	-65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	7	40	V
V_I	Amplifier Input Voltage	-0.3	V_{CC} - 2	V
V_O	Collector Output Voltage		40	V
	Collector Output Current (Each Transistor)		200	mA
	Current Into Feed back Terminal		0.3	mA
C_T	Timing Capacitor	0.47	10.000	nF
R_T	Timing Resistor	1.8	500	KΩ
	Oscillator Frequency	1	300	KHz
T_A	Operating Free-Air Temperature	-20	+85	°C

ELECTRICAL CHARACTERISTICS (Temperature -20 ~ 85°C, V_{CC} = 15 V, f=10 kHz))

Symbol	Parameter	Test Conditions		Min	Max	Unit
Reference Section						
V_{ref}	Output Voltage	I_O=1 mA		4.75	5.25	V
V_{regin}	Output regulation	V_{CC}=7 V to 40 V, T_A=25°C			25	mV
V_{regout}	Input regulation	I_O=1 to 10 mA, T_A=25°C			15	mV
ΔV_{ref}	Output Voltage change with temperature	T_A= -20°C to 85°C			1	%
I_{SC}	Short-circuit output current (Note 1)	Vref=0			50	mA
Oscillator Section						
f_{OSC}	Frequency	C_T=0.01 µF, R_T=12 kΩ		6	14	KHz
δf_{OSC}	Standard deviation of frequency (Note 2)	All values of V_{CC}, C_T, R_T, T_A Constant			15	%
$\delta f_{OSC(\Delta V)}$	Frequency change with voltage	V_{CC}= 7 V to 40 V, T_A=25°C			10	%
$\delta f_{OSC(\Delta T)}$	Frequency change with temperature	C_T=0.01 µF, R_T=12 kΩ T_A= -20°C to 85°C			2	%
Dead Time Control Section						
$I_{IB(2T)}$	Input bias current (pin 4)	V_I= 0 to 5.25 V			-10	µA
DC_{max}	Maximum duty cycle, each output	$V_{I(pin\ 4)}$=0 V		45		%
V_{THD}	Input threshold voltage	Zero duty cycle			3.3	V
	(pin 4)	Maximum duty cycle		0		
Error Amp Section						
V_{IO}	Input offset voltage	$V_{O(pin\ 3)}$=2.5 V			10	mV
I_{IO}	Input offset current	$V_{O(pin\ 3)}$=2.5 V			250	nA
I_{IB}	Input bias current	$V_{O(pin\ 3)}$=2.5 V			1	µA
	Common-mode input	V_{CC}= 7 V to 40 V	LOW	-0.3		V
	voltage range		HIGH	V_{CC} - 2		
A_{vol}	Open-loop voltage amplification	ΔV_O=3 V, V_O=0.5 to 3.5 V		70		dB
f_b	Unity-gain bandwidth			100		kHz
CMRR	Common-mode rejection ratio	V_{CC}=40 V, T_A=25°C		65		dB
I_O	Output sink current (pin 3)	V_{ID}=-15 mV to -5 V, $V_{O(pin\ 3)}$=0.7 V		0.3		mA
I_{O+}	Output source current (pin 3)	V_{ID}=15 mV to 5 V, $V_{O(pin\ 3)}$=3.5 V		-2		mA

ELECTRICAL CHARACTERISTICS (Temperature -20 ~ 85°C, V_{CC} = 15 V, f=10 kHz))

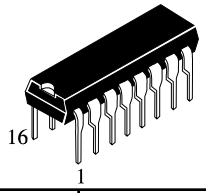
Symbol	Parameter		Test Conditions		Min	Max	Unit
PWM Comparator Section							
V_{THP}	Input threshold voltage (pin 3)		Zero duty cycle			4.5	V
I_I	Input sink current (pin 3)		$V_{O(pin\ 3)}$=0.7 V		0.3		mA
Switching Characteristics							
t_{rc}	Output voltage rise time		Common-emitter configuration			200	ns
t_{fc}	Output voltage fall time		Common-emitter configuration			100	ns
t_{rf}	Output voltage rise time		Emitter-follower configuration			200	ns
t_{ff}	Output voltage fall time		Emitter-follower configuration			100	ns
Output Section							
$I_{C(off)}$	Collector off-state current		V_{CE}=40 V, V_{CC}=40 V			100	µA
$I_{E(off)}$	Emitter off-state current		V_{CC}=V_C=40 V, V_E=0			-100	µA
V_{SAT}	Collector-emitter saturation voltage	Common-emitter	V_E=0, I_C=200 mA			1.3	V
		Emitter-follower	V_C=15 V, I_E=-200 mA			2.5	
I_{OCH}	Output control input current		V_I=V_{ref}			3.5	mA
Total Device							
I_{CC}	Standby supply current		All other inputs & outputs open	V_{CC}=15 V		10	mA
				V_{CC}=40 V		15	
I_{CCA}	Average supply current		$V_{(pin\ 4)}$=2 V			17	mA

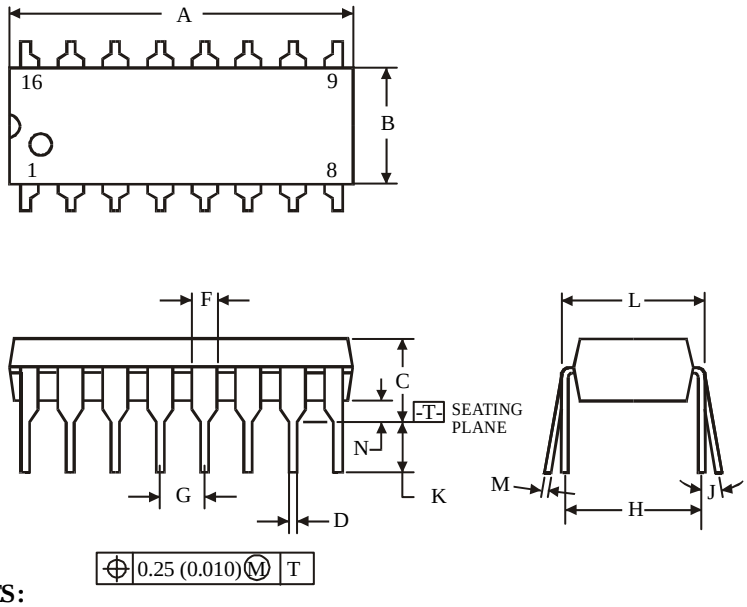
Notes: 1. Duration of the short circuit should not exceed one second.

2. Standard deviation is a measure of the statistical disribution about the mean as derived from the formula

$$\sigma = \sqrt{\frac{\sum_{n=1}^{N} (x_n - \overline{x})^2}{N - 1}}$$

N SUFFIX PLASTIC DIP
(MS - 001BB)



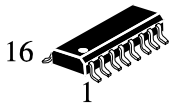


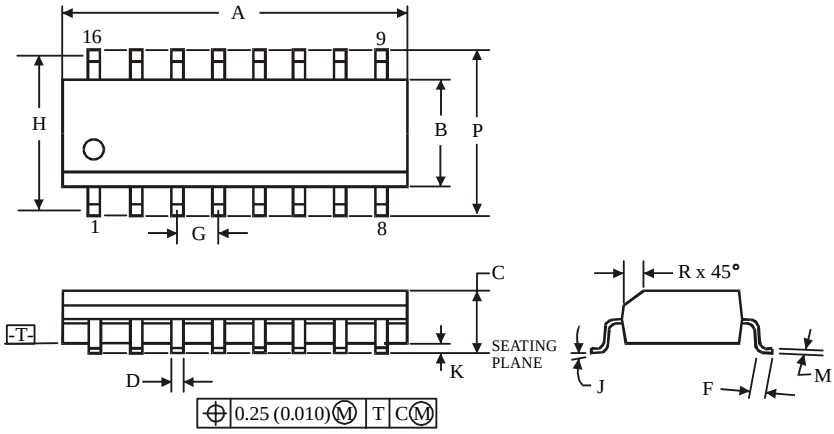
	Dimension, mm	
Symbol	**MIN**	**MAX**
A	18.67	19.69
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

NOTES:

1. Dimensions “A”, “B” do not include mold flash or protrusions.
   Maximum mold flash or protrusions 0.25 mm (0.010) per side.

D SUFFIX SOIC
(MS - 012AC)





	Dimension, mm	
Symbol	**MIN**	**MAX**
A	9.8	10
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

NOTES:

1. Dimensions A and B do not include mold flash or protrusion.
2. Maximum mold flash or protrusion 0.15 mm (0.006) per side
   for A; for B – 0.25 mm (0.010) per side.