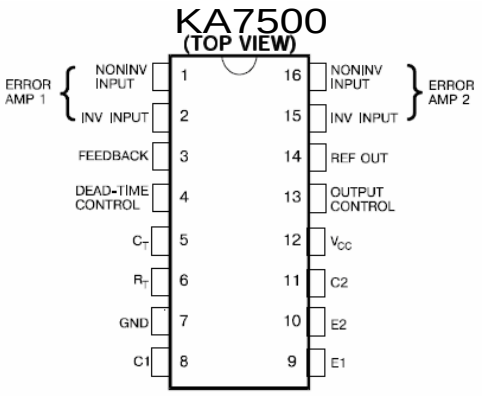
FEATURES

- 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 Pulse at Either Output
- Variable Dead-Time Provides Control over Total Range
- Internal Regulator Provides a Stable 5-V Reference Supply, 1%
- Circuit Architecture Allows Easy Synchronization



DESCRIPTION

The **KA7500** 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, these devices offer the systems engineer the flexibility to tailor the power supply control circuitry to his application.

The **KA7500** contains an error amplifier, an on-chip adjustable oscillator, a dead-time control comparator, pulse-steering control flip-flop, a 5-volt, 1% precision regulator, and output-control circuits. The error amplifier exhibits a common-mode voltage range from -0.3 volts to V_{CC} -2 volts. 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 uncommited 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 output being pulsed twice during push-pull operation.

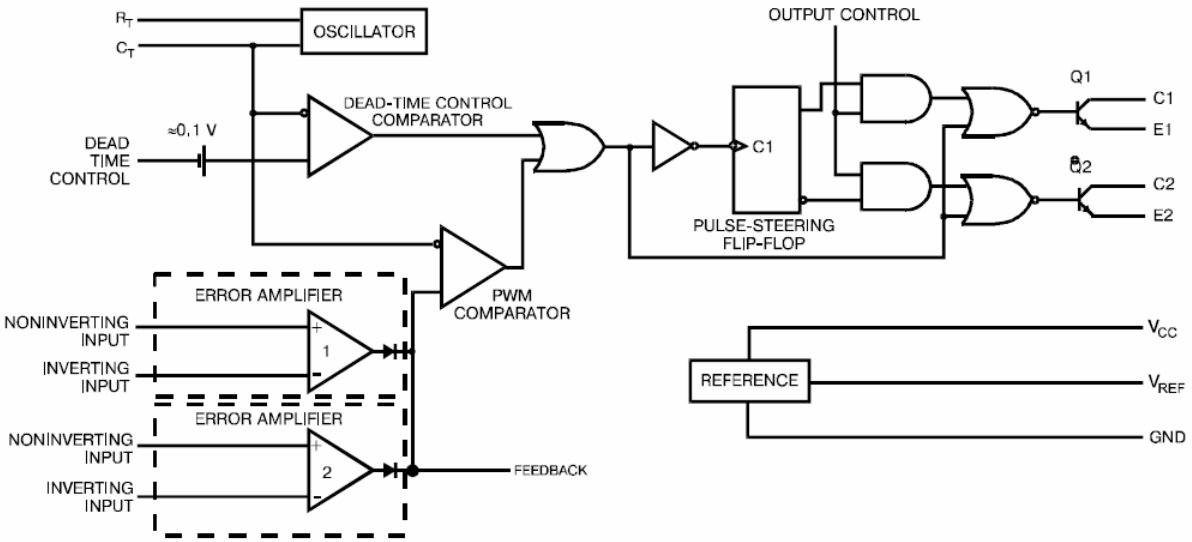
Absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Rating	Value	Unit
Supply voltage, V_{CC}	42	V
Amplifier input voltage	V_{CC}+0.3	
Collector output voltage	41	
Collector output current	250	mA
Operating free-air temperature range	0 to 70	℃
Storage temperature range	-65 to 150	
Lead temperature 1,6 mm from case for 10 seconds	260	

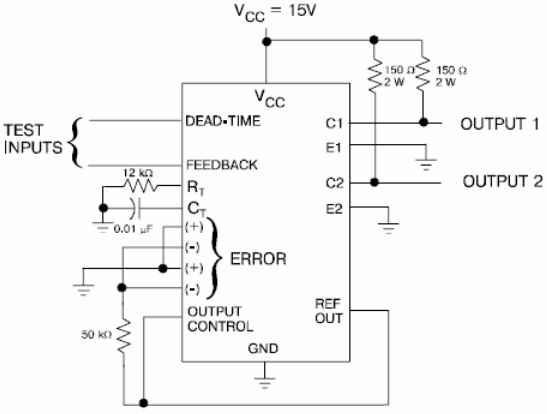
Recommended operating conditions

Parameter	Value		Unit
	MIN	MAX	
Supply voltage, V_{CC}	7	40	V
Amplifier input voltage, Vi	-0.3	V_{CC}-2	
Collector output voltage, V_O		40	
Collector output current (each transistor)		200	mA
Current into feedback terminal		0.3	
Timing capacitor, C_T	0.0047	10	μF
Timing resistor, R_T	1.8	500	kΩ
Oscillator frequency	1	200	kHz
Operating free-air temperature, T_A	0	70	℃

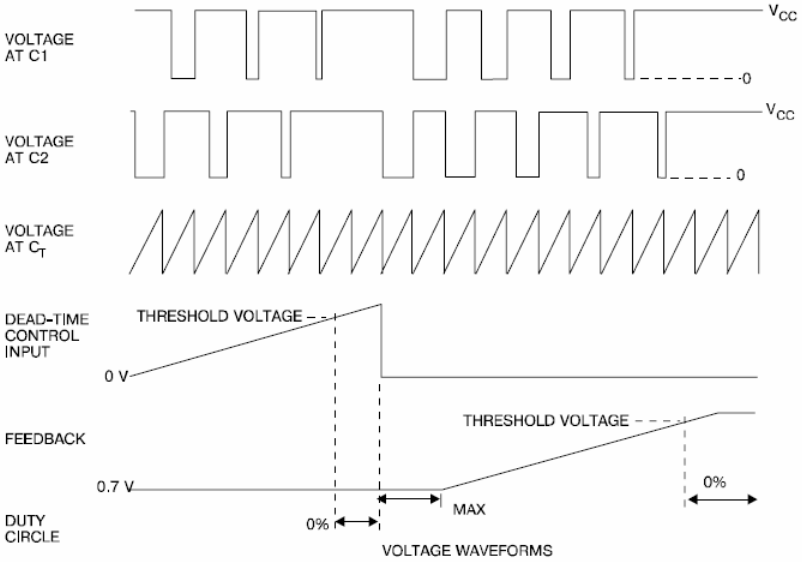
FUNCTIONAL BLOCK DIAGRAM



Parameter measurement information



TEST CIRCUIT



VOLTAGE WAVEFORMS

FIGURE 1. OPERATIONAL TEST CIRCUIT AND WAVEFORMS

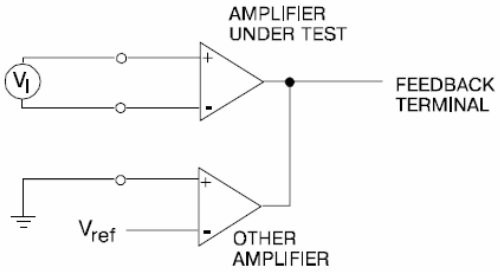


FIGURE 2. AMPLIFIER CHARACTERISTICS

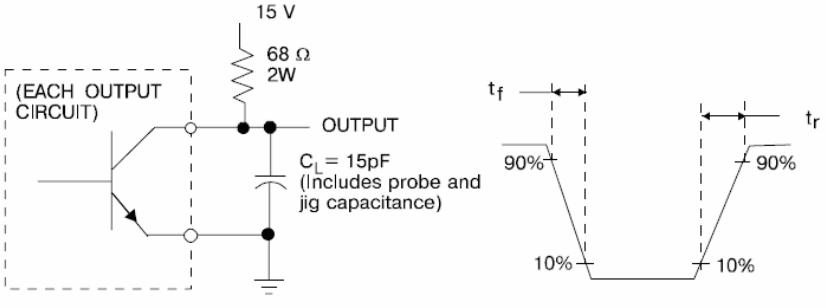


FIGURE 3. COMMON-EMITTER CONFIGURATION

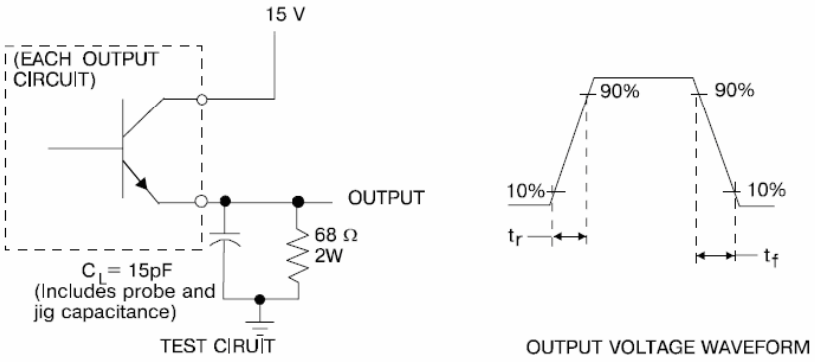


FIGURE 4. EMITTER-FOLLOWER CONFIGURATION

Electrical characteristics over recommended operating free-air temperature range, V_{CC}=15V, f=10 kHz (unless otherwise noted).

Reference section

Parameter	Test conditions	Value			Unit
		MIN	TYP**	MAX	
Output voltage (V_{ref})	I_O = 1mA	4.9	5	5.1	V
	I_O = 1mA, T_A=25°C****	4.95	5	5.05	
Line regulation	V_{CC} = 7V to 40 V		2	25	mV
Load regulation	I_O = 1mA to 10 mA		1	15	
Short-circuit output current***	V_{ref} = 0	10	35	50	mA

Oscillator section (see Figure 1)

Parameter	Test conditions*	Value			Unit
		MIN	TYP**	MAX	
Frequency	C_T = 0.01 µF, R_T = 12kΩ	9.0	-	12	kHz
Frequency change with temperature *****	C_T = 0.01 µF, R_T = 12kΩ, ΔT_A = MIN to MAX			2	%

Electrical characteristics over recommended operating free-air temperature range, V_{CC}=15V, f=10 kHz (unless otherwise noted).

Amplifier section (see Figure 2)

Parameter	Test conditions	Value			Unit
		MIN	TYP**	MAX	
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	μA
Common-mode input voltage range	V_{CC} = 7V to 40 V	-0.3 to V_{CC}-2			V
Open-loop voltage amplification	ΔV_O = 3V, R_L = 2kΩ, V_O = 0.5 to 3.5V	70	95		dB
Unity-gain bandwidth			650		kHz

Output section

Parameter		Test conditions	Value			Unit
			MIN	TYP**	MAX	
Collector off-state current		V_{CE}=40 V, V_{CC}=40 V		2	100	μA
Emitter off-state current		V_{CC}=V_C=40 V, V_E=0			-100	
Collector-emitter saturation voltage	Common-emitter	V_E=0, I_C=200 mA		1.1	1.3	V
	Emitter-follower	V_C=15V, I_E=-200 mA		1.5	2.5	
Output control input current		V_I=V_{ref}			3.5	mA

Dead-time control-section (see Figure 1)

Parameter	Test conditions	Value			Unit
		MIN	TYP**	MAX	
Input bias current (pin 4)	V_I=0 to 5.25V		-2	-10	μA
Maximum duty cycle, each output	$V_{I\ (pin\ 4)}$=0, O. C.=V_{ref}	45			%
Input threshold voltage (pin 4)	Zero duty cycle		3	3.3	V
	Maximum duty cycle	0			

PWM comparator section (see Figure 1)

Parameter	Test conditions	Value			Unit
		MIN	TYP**	MAX	
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

Parameter	Test conditions	Value			Unit
		MIN	TYP**	MAX	
Standby supply current	Pin 6 at V_{ref} V_{CC}=15V		6	10	mA

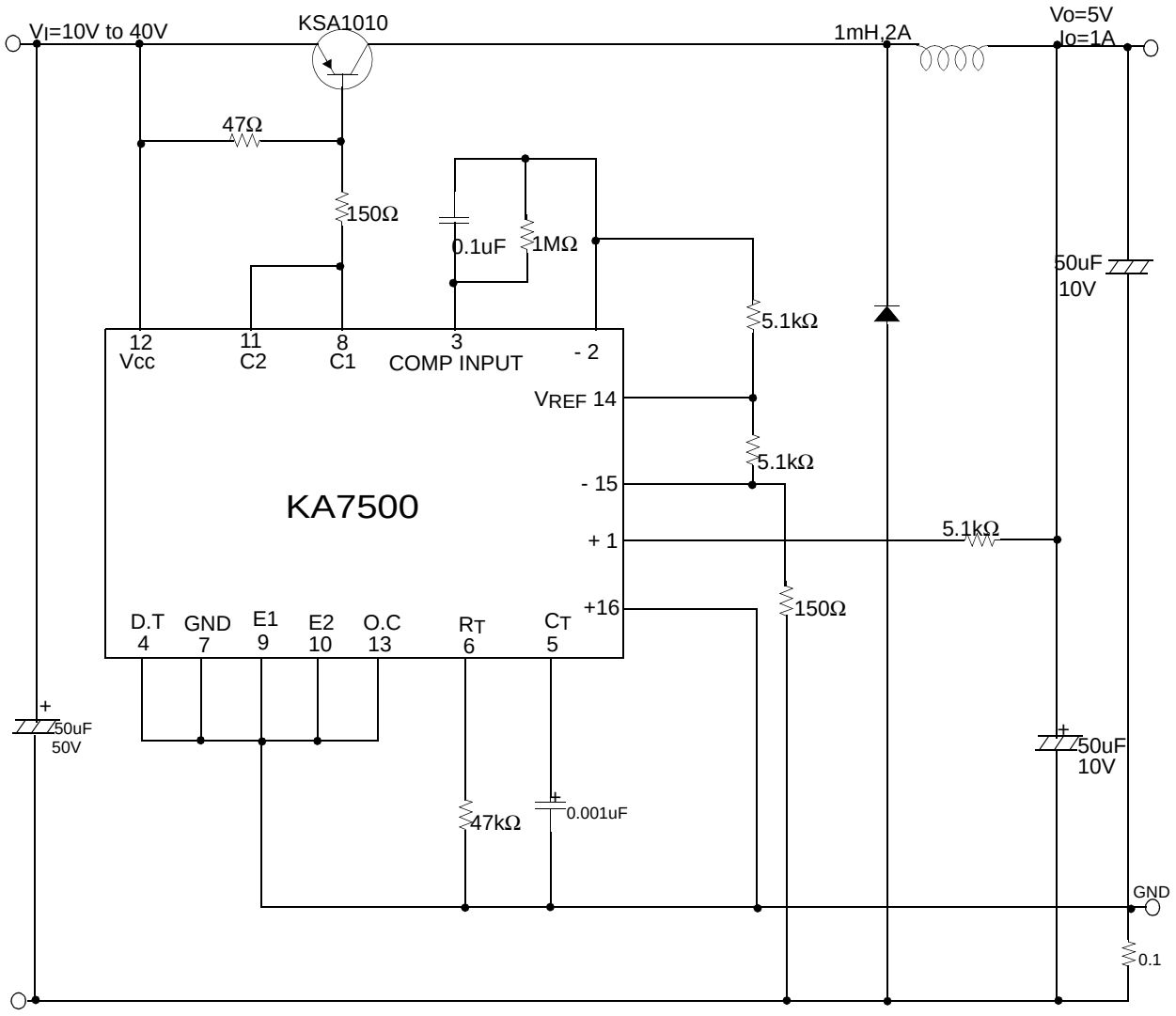
Switching characteristics, T_A = 25°C

Parameter	Test conditions	Value			Unit
		MIN	TYP**	MAX	
Output voltage rise time	Common-emitter configuration,		100	200	ns
Output voltage fall time	See figure 3		25	100	
Output voltage rise time	Emitter-follower configuration.		100	200	
Output voltage fall time	See Figure 4		25	100	

* For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
** All typical values except for parameter changes with temperature are at T_A = 25°C
*** Duration of the short-circuit should not exceed one second
**** This is guaranteed where the marking code on the package surface is ●AB
***** Temperature coefficient of timing capacitor and timing resistor not taken Into account

Typical Application

Pulse Width Modulated Step-down Converter



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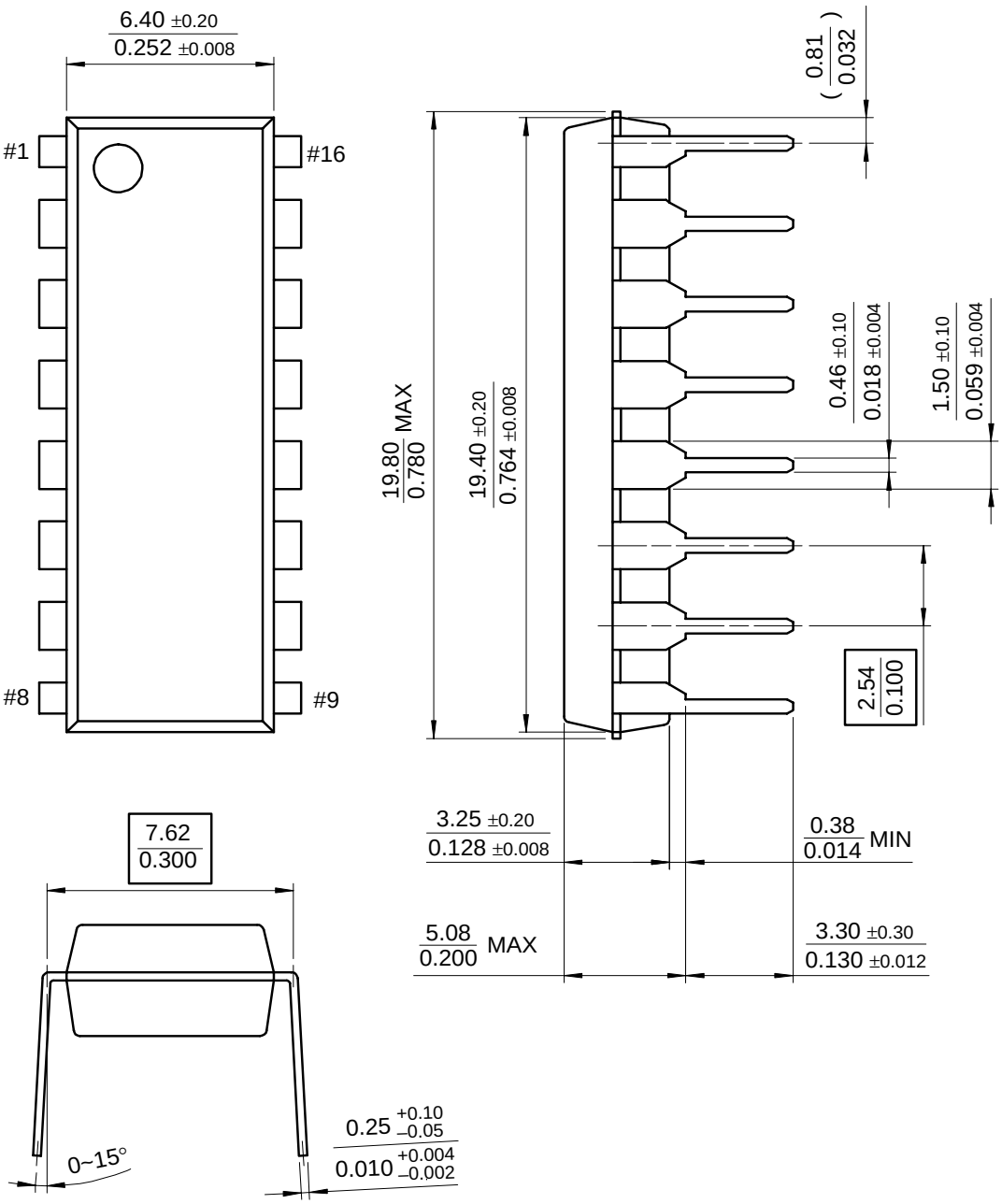
Package

16-DIP



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Package

16-SOP