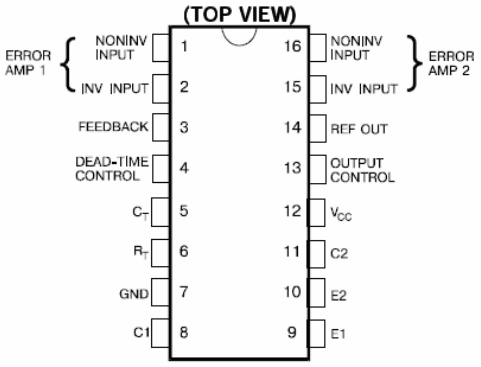
DP494

PWM Power Control Circuitry

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 DP494 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 DP494 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.

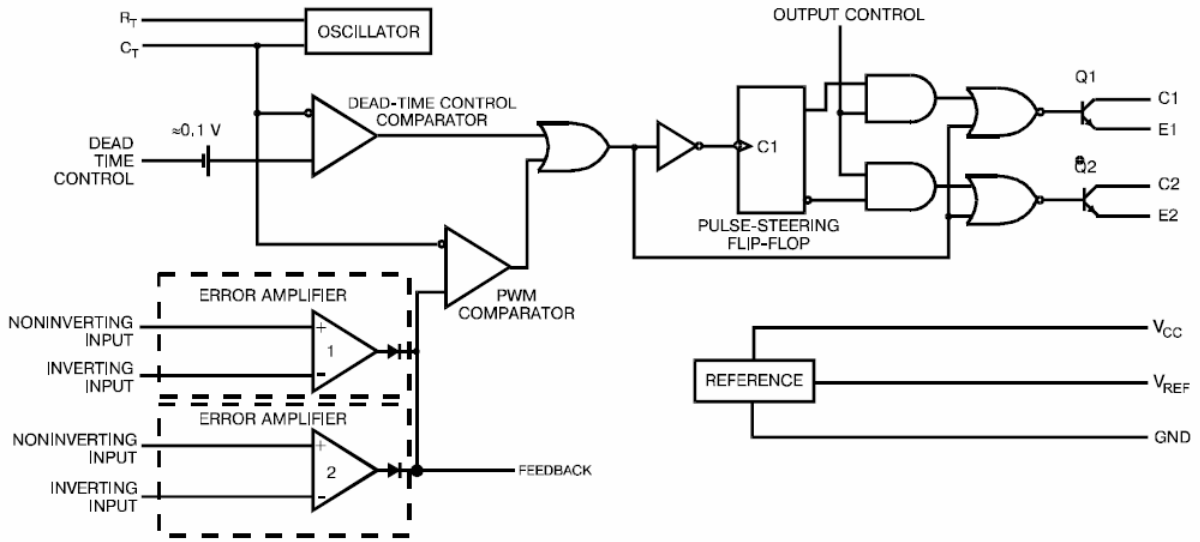
Absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

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	

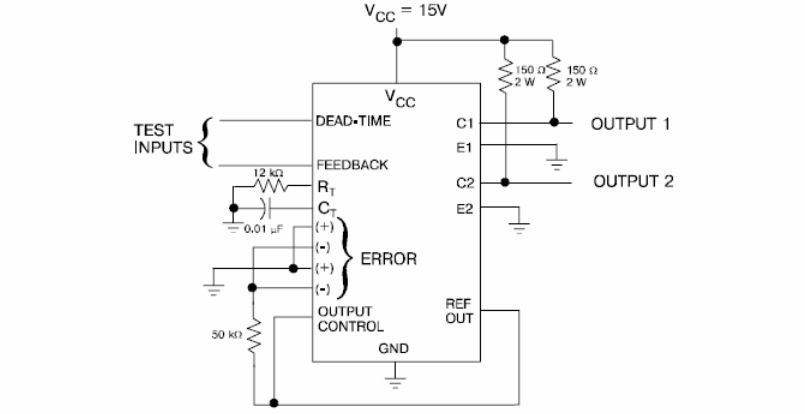
Recommended operating conditions

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	0.00 47	10	μF
Timing resistor, R_T	1.8	500	kΩ
Oscillator frequency	1	200	kHz
Operating free-air temperature, T_A	0	70	℃

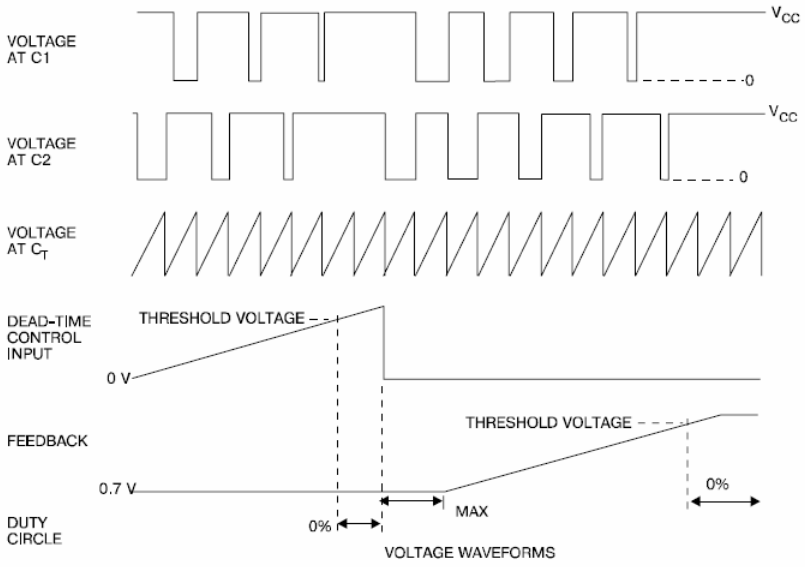
FUNCTIONAL BLOCK DIAGRAM



Parameter measurement information



TEST CIRCUIT



VOLTAGE WAVEFORMS

FIGURE 1. OPERATIONAL TEST CIRCUIT AND WAVEFORMS

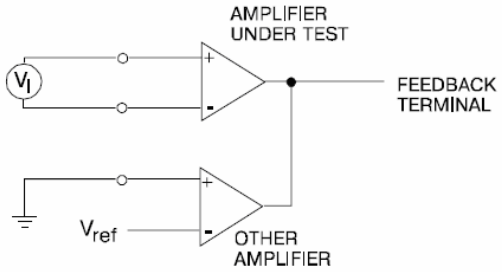


FIGURE 2. AMPLIFIER CHARACTERISTICS

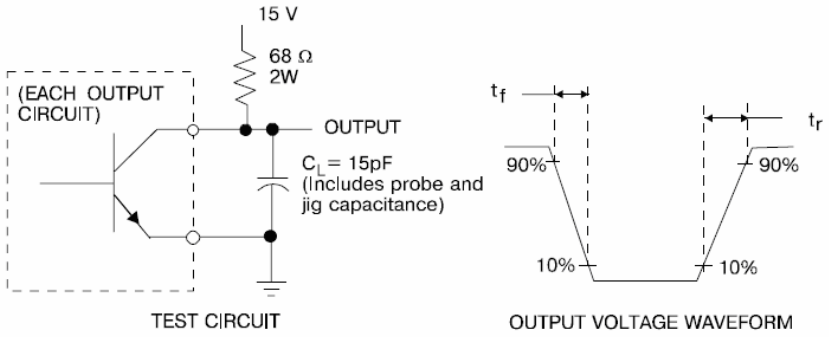


FIGURE 3. COMMON-EMITTER CONFIGURATION

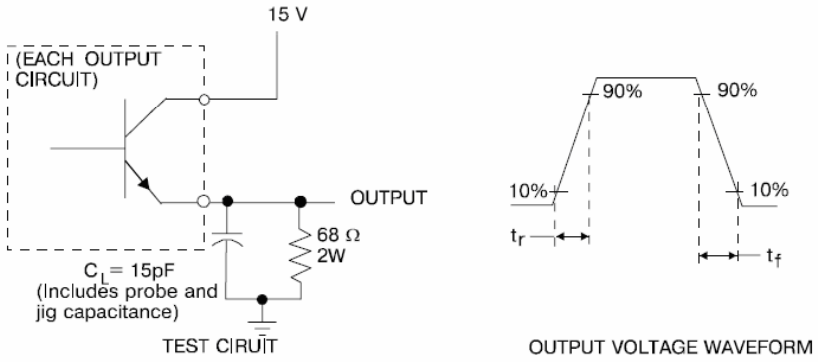


FIGURE 4. EMITTER-FOLLOWER CONFIGURATION

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

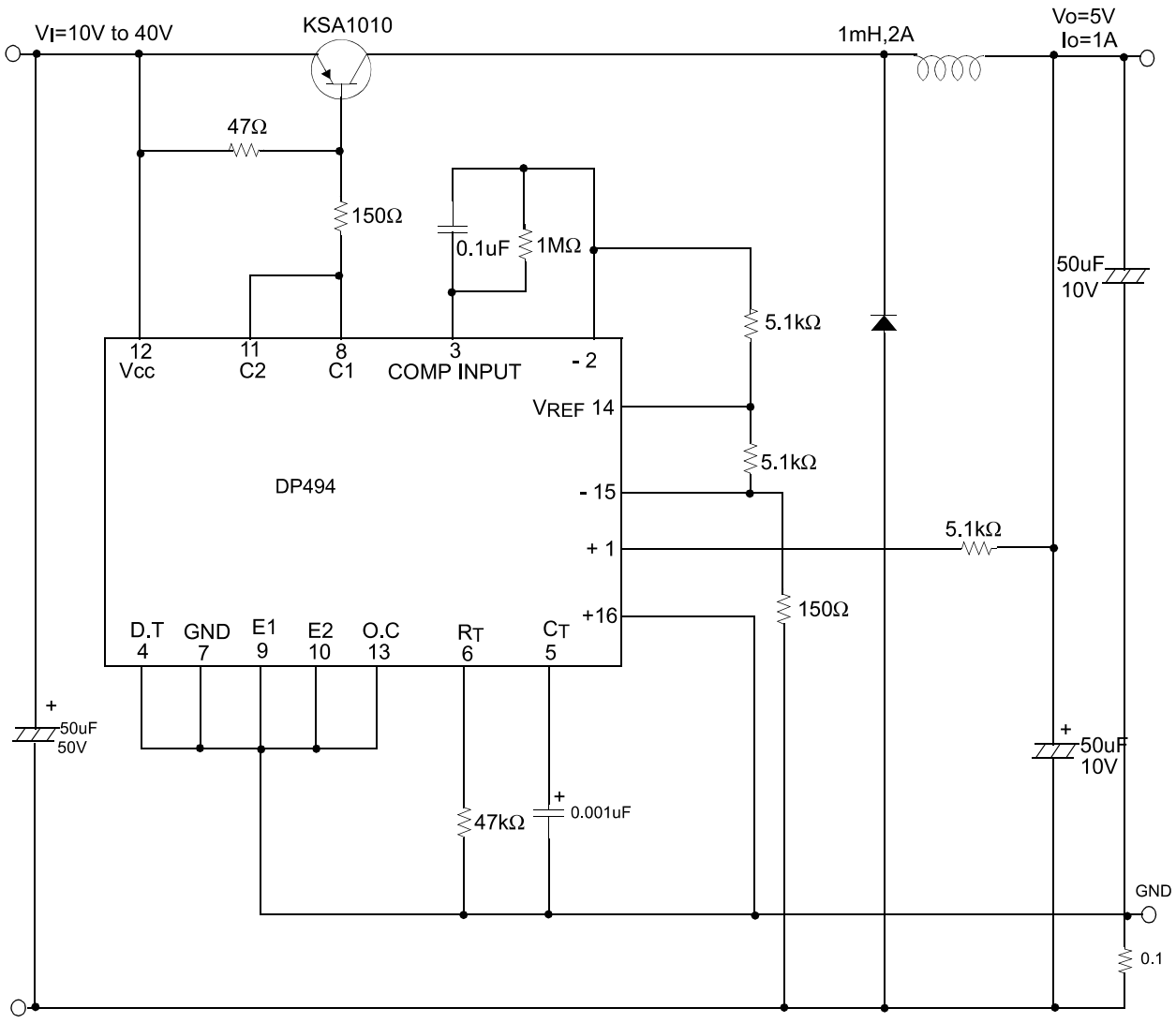
Switching characteristics, T_A = 25°C

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

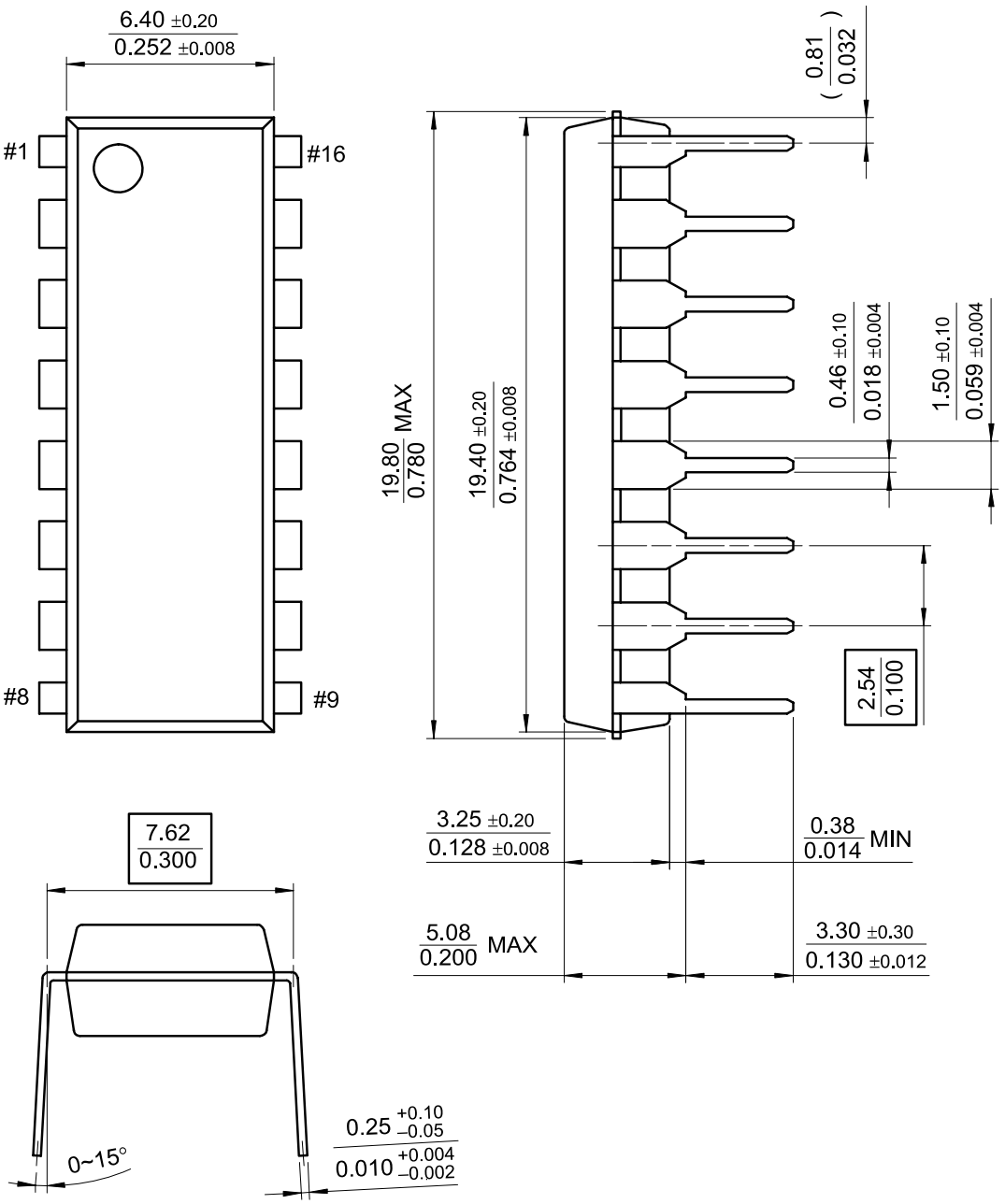
Pulse Width Modulated Step-down Converter



Mechanical Dimensions

Package

16-DIP



Mechanical Dimensions (Continued)

Package

16-SOP