

### General Description

The AZ496 is a voltage mode pulse width modulation switching regulator control circuit designed primarily for power supply control.

The AZ496 consists of a reference voltage circuit, two error amplifiers, an on-chip adjustable oscillator, a dead-time control (DTC) comparator, a pulse-steering control flip-flop, and an output control circuit. The precision of voltage reference ( $V_{REF}$ ) is improved up to  $\pm 1\%$  through trimming and this provides a better output voltage regulation. The AZ496 provides for push-pull or single-ended output operation, which can be selected through the output control.

The PWM IC is specially designed for half bridge converter and can simplify the drive circuit.

The AZ496 is available in SOIC-16 and DIP-16 packages.

### Features

- Stable 4.95V Reference Voltage Trimmed to  $\pm 1.0\%$  Accuracy
- Uncommitted Output TR for 100mA Sink or Source Current
- Single-end or Push-pull Operation Selected by Output Control
- Internal Circuitry Prohibits Double Pulse at Either Output
- Complete PWM Control Circuit with Variable Duty Cycle
- On-Chip Oscillator with Master or Slave Operation

### Applications

- SMPS
- Back Light Inverter
- Charger

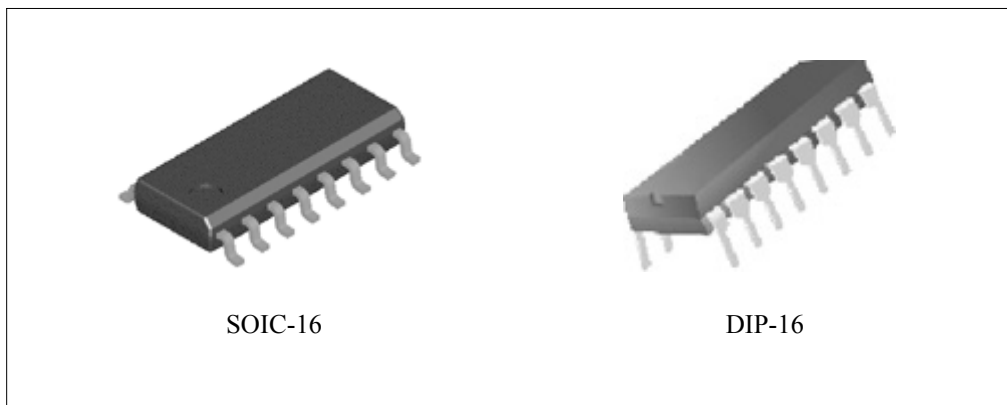


Figure 1. Package Types of AZ496

**PULSE-WIDTH-MODULATION CONTROL CIRCUITS**

**AZ496**

**Pin Configuration**

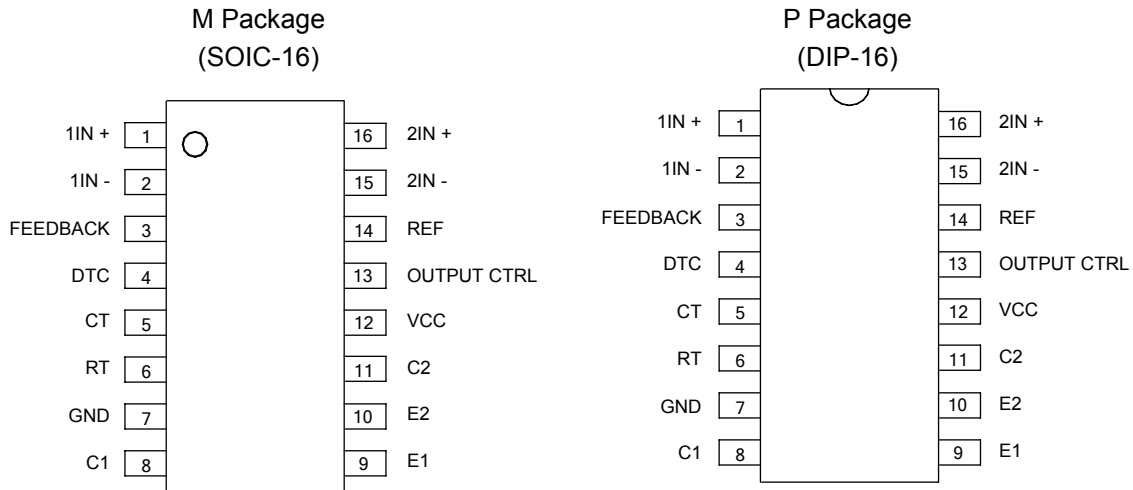


Figure 2. Pin Configuration of AZ496 (Top View)

**Output Function Control Table**

Signal for Output Control	Output Function
$V_I = GND$	Single-ended or parallel output
$V_I = V_{REF}$	Normal push-pull operation

**Functional Block Diagram**

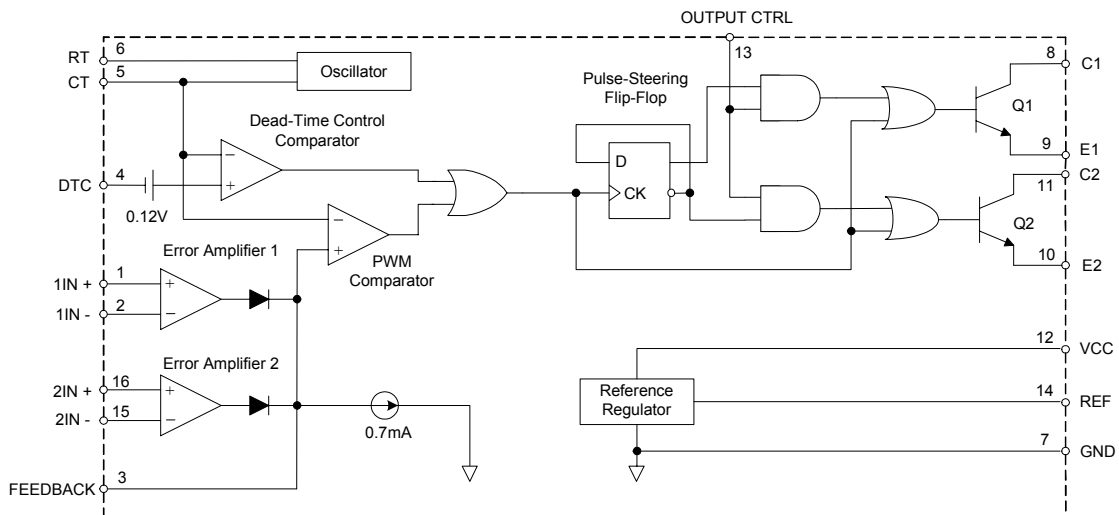


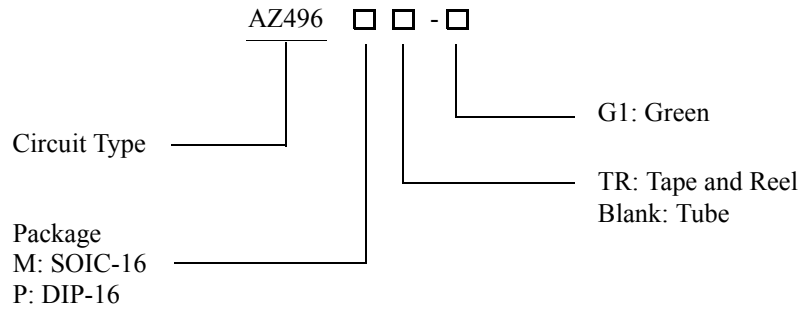
Figure 3. Functional Block Diagram of AZ496



**PULSE-WIDTH-MODULATION CONTROL CIRCUITS**

**AZ496**

**Ordering Information**



Package	Temperature Range	Part Number	Marking ID	Packing Type
SOIC-16	-40 to 85°C	AZ496M-G1	AZ496M-G1	Tube
		AZ496MTR-G1	AZ496M-G1	Tape & Reel
DIP-16		AZ496P-G1	AZ496P-G1	Tube

BCD Semiconductor's products, as designated with "G1" suffix in the part number, are RoHS compliant and Green.

**PULSE-WIDTH-MODULATION CONTROL CIRCUITS****AZ496****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit	
Supply Voltage (Note 2)	$V_{CC}$	40	V	
Amplifier Input Voltage	$V_I$	-0.3 to $V_{CC} + 0.3$	V	
Collector Output Voltage	$V_O$	40	V	
Collector Output Current	$I_O$	150	mA	
Package Thermal Impedance (Note 3)	$\theta_{JA}$	SOIC-16	73	°C/W
		DIP-16	67	
Lead Temperature 1.6mm from case for 10 seconds	$T_{LEAD}$	260	°C	
Storage Temperature Range	$T_{STG}$	-65 to 150	°C	
ESD rating (Machine Model)		200	V	

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

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

Note 3: Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$  and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\max) - T_A) / \theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.

**Recommended Operating Conditions**

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	$V_{CC}$	7	15	36	V
Collector Output Voltage	$V_{C1}, V_{C2}$		30	36	V
Collector Output Current (Each Transistor)	$I_{C1}, I_{C2}$			100	mA
Amplifier Input Voltage	$V_I$	0.3		$V_{CC} - 2$	V
Current Into Feedback Terminal	$I_{FB}$			0.3	mA
Reference Output Current	$I_{REF}$			10	mA
Timing Capacitor	$C_T$	0.00047	0.001	10	µF
Timing Resistor	$R_T$	1.8	30	500	KΩ
Oscillator Frequency	$f_{osc}$	1.0	40	100	KHz
PWM Input Voltage (Pin 3, 4, 14)		0.3		5.3	V
Operating Free-Air Temperature	$T_A$	-40		85	°C



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**Electrical Characteristics**

$T_A=25^{\circ}\text{C}$ ,  $V_{CC}=20\text{V}$ ,  $f=10\text{KHz}$  unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Reference Section</b>						
Output Reference Voltage	$V_{REF}$	$I_{REF}=1\text{mA}$	4.90	4.95	5.0	V
		$I_{REF}=1\text{mA}$ , $T_A=-40$ to $85^{\circ}\text{C}$	4.85	4.95	5.05	V
Line Regulation	$R_{LINE}$	$V_{CC}=7\text{V}$ to $36\text{V}$		2	25	mV
Load Regulation	$R_{LOAD}$	$I_{REF}=1\text{mA}$ to $10\text{mA}$		1	15	mV
Short-Circuit Output Current	$I_{SC}$	$V_{REF}=0\text{V}$	10	35	50	mA
<b>Oscillator Section</b>						
Oscillator Frequency	$f_{OSC}$	$C_T=0.001\mu\text{F}$ , $R_T=30\text{K}\Omega$		40		kHz
		$C_T=0.01\mu\text{F}$ , $R_T=12\text{K}\Omega$	9.2	10	10.8	
		$C_T=0.01\mu\text{F}$ , $R_T=12\text{K}\Omega$ , $T_A=-40$ to $85^{\circ}\text{C}$	9.0		12	
Frequency Change with Temperature	$\Delta f/\Delta T$	$C_T=0.01\mu\text{F}$ , $R_T=12\text{K}\Omega$ , $T_A=-40$ to $85^{\circ}\text{C}$			1	%
<b>Dead-Time Control Section</b>						
Input Bias Current	$I_{BIAS}$	$V_{CC}=15\text{V}$ , $V_4=0$ to $5.25\text{V}$		-2	-10	$\mu\text{A}$
Maximum Duty Cycle	$D(\text{MAX})$	$V_{CC}=15\text{V}$ , $V_4=0\text{V}$ , $\text{Pin } 13=V_{REF}$	45			%
Input Threshold Voltage	$V_{ITH}$	Zero Duty Cycle		3	3.3	V
		Maximum Duty Cycle	0			
<b>Error-Amplifier Section</b>						
Input Offset Voltage	$V_{IO}$	$V_3=2.5\text{V}$		2	10	mV
Input Offset Current	$I_{IO}$	$V_3=2.5\text{V}$		25	250	nA
Input Bias Current	$I_{BIAS}$	$V_3=2.5\text{V}$		0.2	1	$\mu\text{A}$
Common-Mode Input Voltage Range	$V_{CM}$	$V_{CC}=7\text{V}$ to $36\text{V}$	-0.3		$V_{CC}-2$	V
Open-loop Voltage Gain	$G_{VO}$	$V_O=0.5\text{V}$ to $3.5\text{V}$	70	95		dB
Unity-Gain Bandwidth	BW			650		kHz
Common-Mode Rejection Ratio	CMRR		65	80		dB
Output Sink Current (Feedback)	$I_{SINK}$	$V_{ID}=-15\text{mV}$ to $-5\text{V}$ , $V_3=0.7\text{V}$	-0.3	-0.7		mA
Output Source Current (Feedback)	$I_{SOURCE}$	$V_{ID}=15\text{mV}$ to $5\text{V}$ , $V_3=3.5\text{V}$	2			mA



**PULSE-WIDTH-MODULATION CONTROL CIRCUITS**

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**Electrical Characteristics (Continued)**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>PWM Comparator Section</b>						
Input Threshold Voltage	$V_{ITH}$	Zero duty cycle		4	4.5	V
Input Sink Current	$I_{SINK}$	$V_3 = 0.7V$	-0.3	-0.7		mA
<b>Output Section</b>						
Output Saturation Voltage	Common Emitter	$V_{CE(SAT)}$ $V_E = 0V, I_C = 200mA$		1.1	1.3	V
	Emitter Follower	$V_{CC(SAT)}$ $V_{CC} = 15V, I_E = -200mA$		1.5	2.5	
Collector Off-State Current	$I_C(OFF)$	$V_{CE} = 36V, V_{CC} = 36V$		2	100	$\mu A$
Emitter Off-State Current	$I_E(OFF)$	$V_{CC} = V_C = 36V, V_E = 0$			-100	$\mu A$
<b>Total Device</b>						
Supply Current	$I_{CC}$	Pin 6 = $V_{REF}$ , $V_{CC} = 15V$		6	10	mA
<b>Output Switching Characteristics</b>						
Rise Time	$t_R$	Common Emitter Common Collector		120	200	ns
Fall Time	$t_F$	Common Emitter Common Collector		50	100	ns

**Parametre Measurement information**

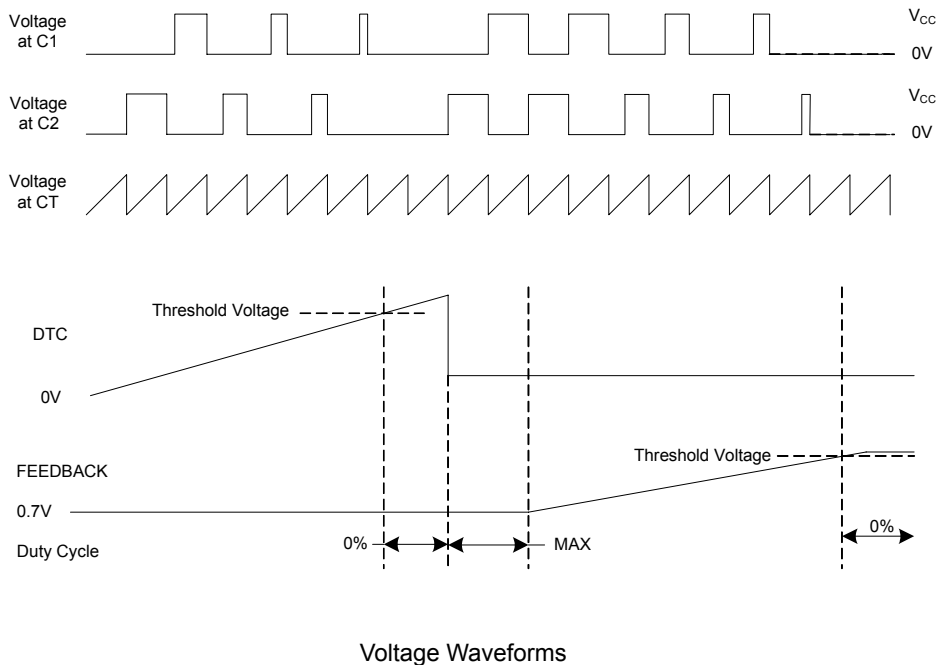


Figure 4. Operational Test Circuit and Waveforms

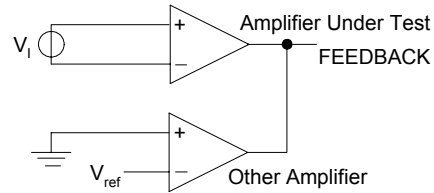
**Parametre Measurement information (Continued)**


Figure 5. Error Amplifier Characteristics

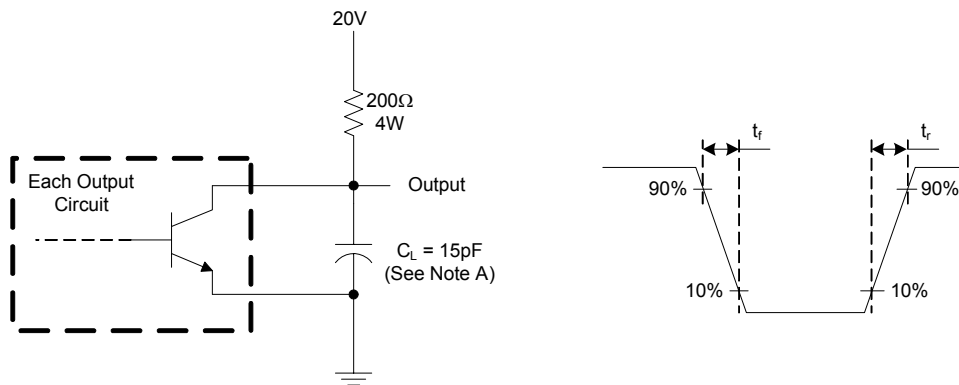

 Note A:  $C_L$  includes probe and jig capacitance.

Figure 6. Common-Emitter Configuration

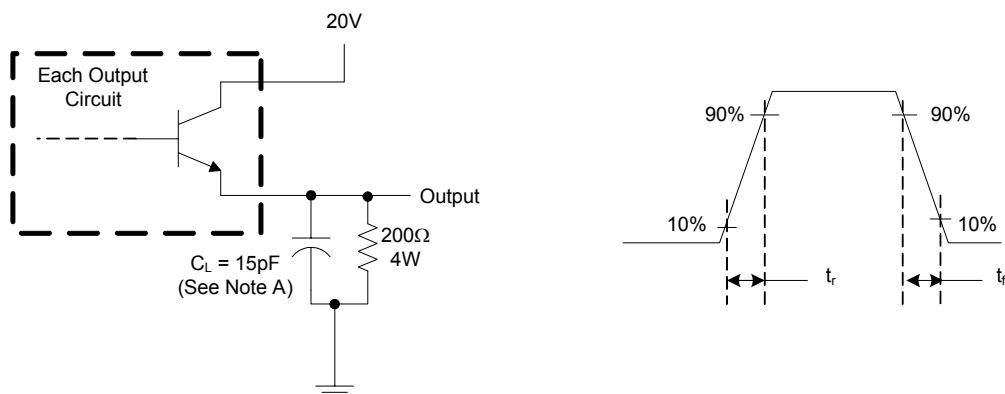

 Note A:  $C_L$  includes probe and jig capacitance.

Figure 7. Emitter-Follower Configuration





**Typical Performance Characteristics**

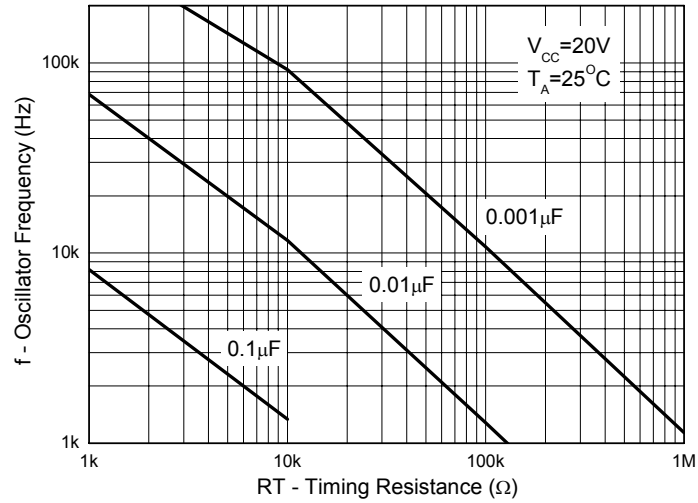


Figure 8. Oscillator Frequency vs. RT and CT

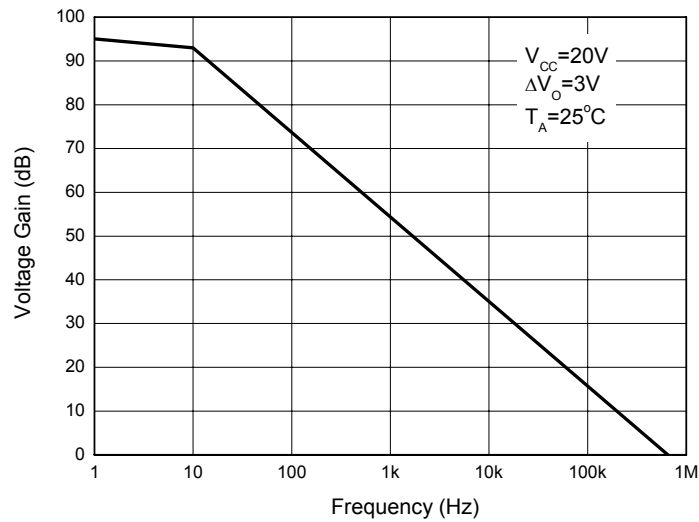


Figure 9. Error Amplifier Small-Signal Voltage Gain vs. Frequency

**Typical Application**

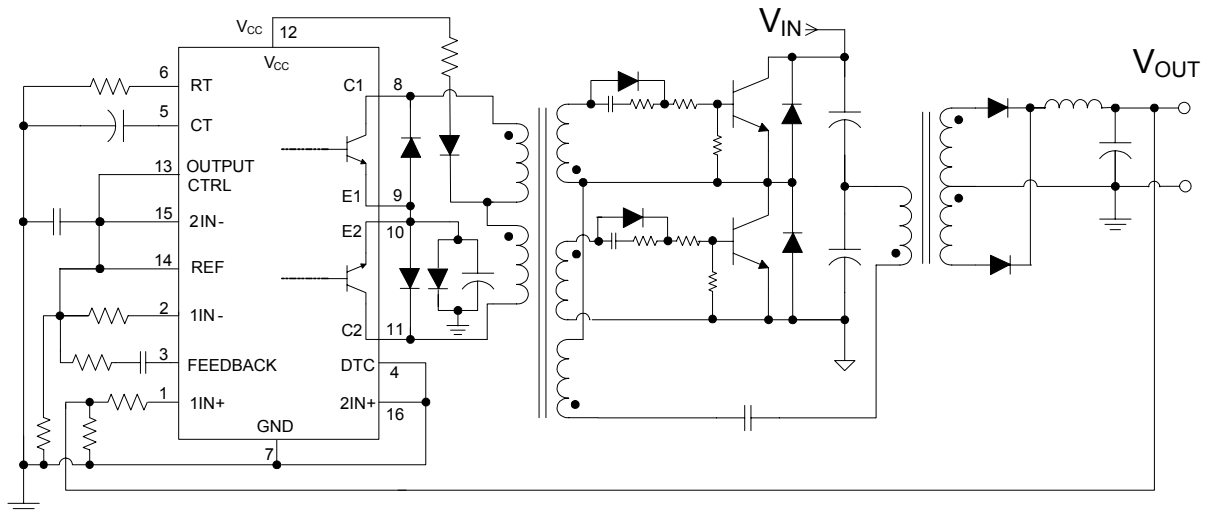


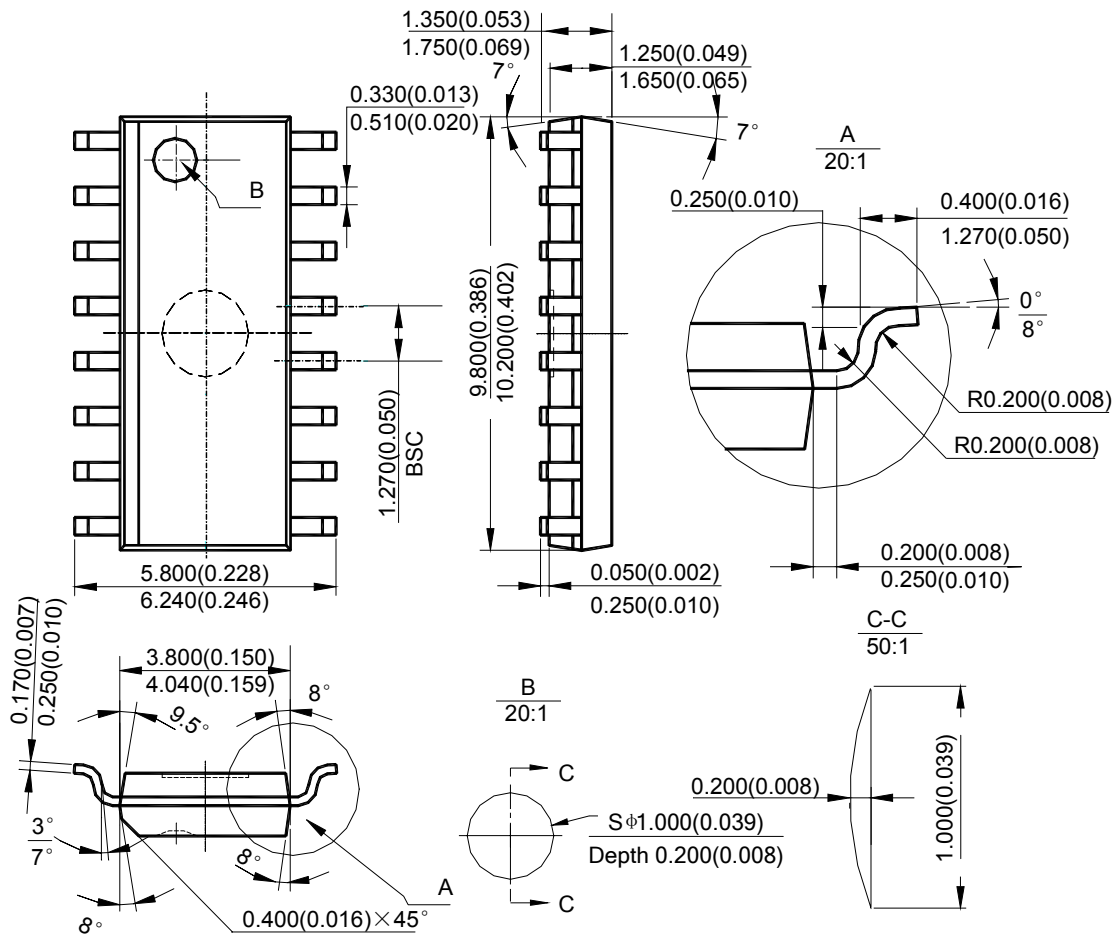
Figure 10. Half Bridge Converter



**Mechanical Dimensions**

**SOIC-16**

**Unit: mm(inch)**



Note: Eject hole, oriented hole and mold mark is optional.



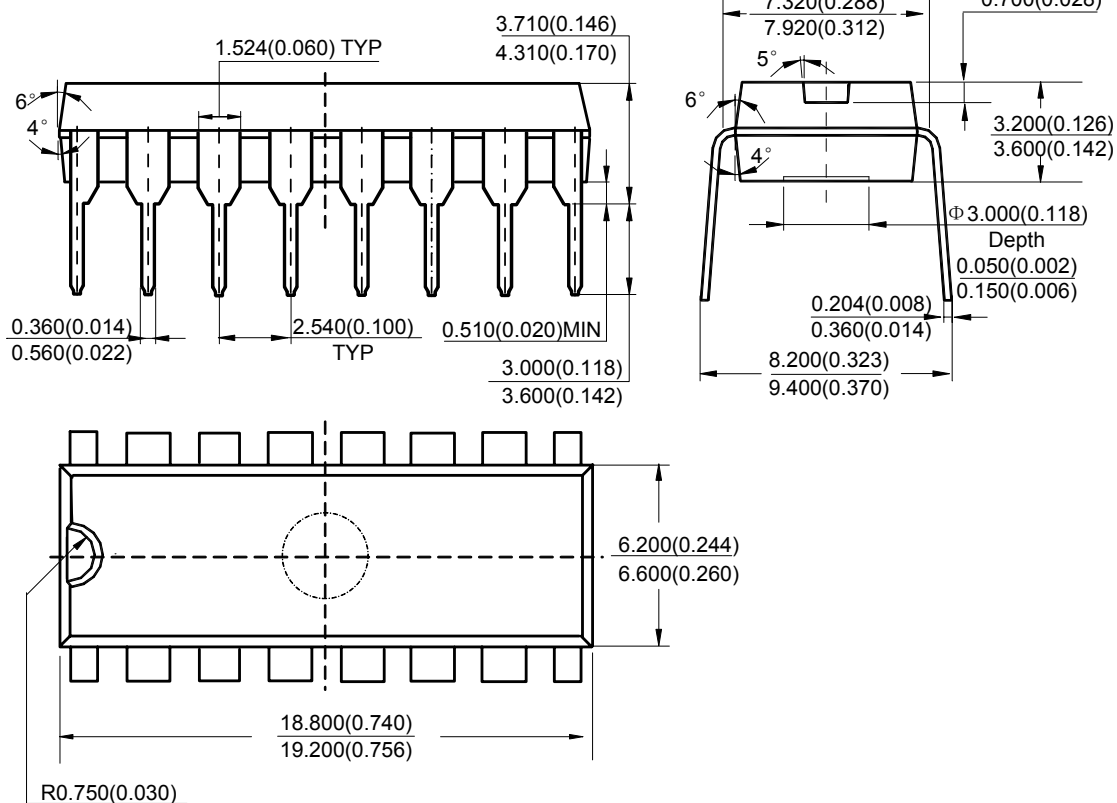
**PULSE-WIDTH-MODULATION CONTROL CIRCUITS**

**AZ496**

**Mechanical Dimensions (Continued)**

**DIP-16**

**Unit: mm(inch)**



Note: Eject hole, oriented hole and mold mark is optional.



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