

VOLTAGE MODE DUAL OUTPUT PWM CONTROLLER

Description

The DIODES™ AZ494 is a voltage mode pulse width modulation switching regulator control circuit designed primarily for power supply control.

The AZ494 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 AZ494 provides for push-pull or single-ended output operation, which can be selected through the output control.

The difference between AZ494A and AZ494C is that they have 4.95V and 5V reference voltage respectively.

The AZ494 is available in standard packages of PDIP-16 and SO-16.

Features

- Stable 4.95V/5V Reference Voltage Trimmed to $\pm 1.0\%$ Accuracy
- Uncommitted Output TR for 200mA 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
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

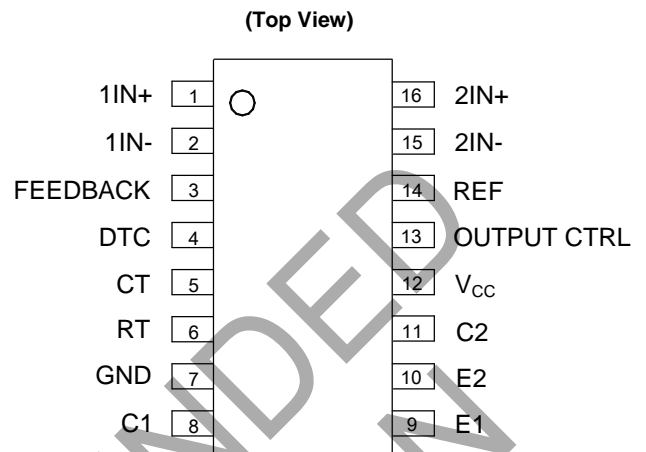
Applications

- SMPS
- Back Light Inverter
- Charger

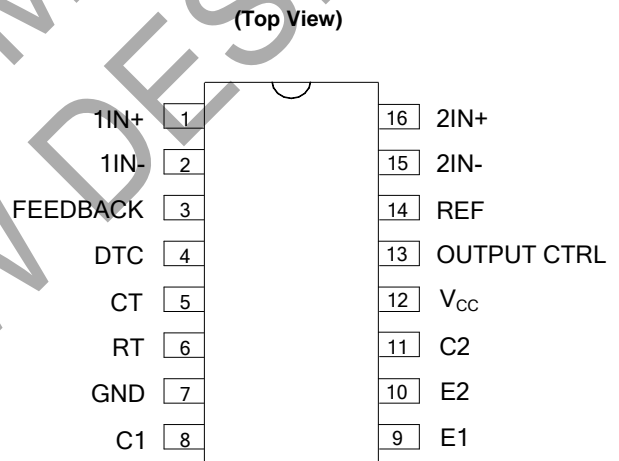
Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Pin Assignments



SO-16

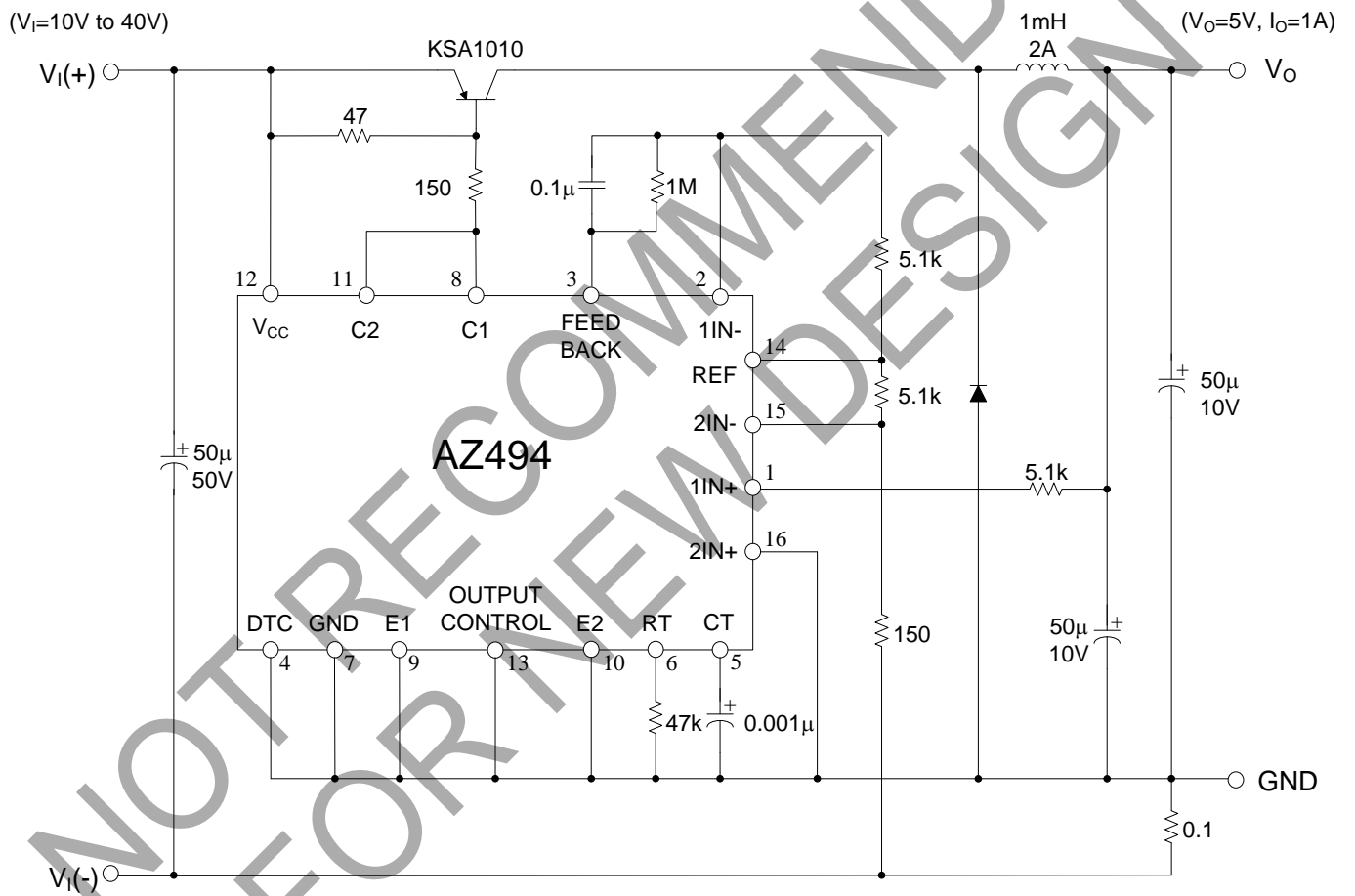


PDIP-16

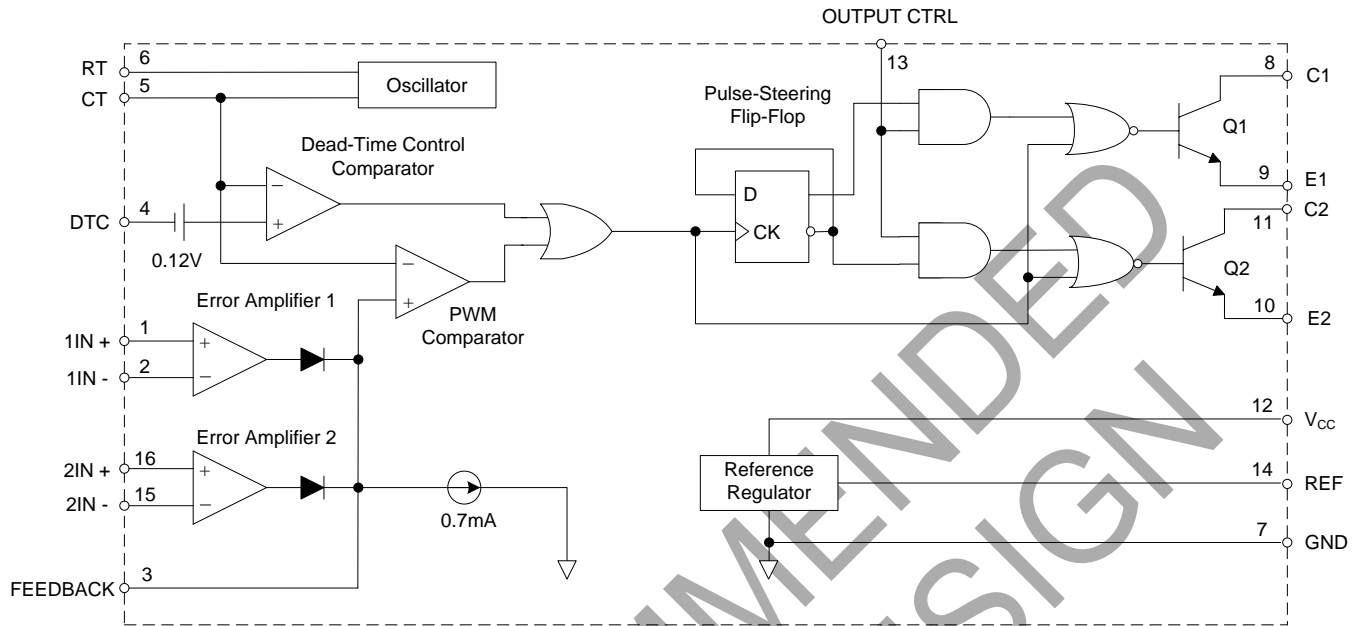
Output Function Control Table

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

Typical Applications Circuit



Functional Block Diagram



Absolute Maximum Ratings (Note 4)

Symbol	Parameter	Rating		Unit
V _{CC}	Supply Voltage (Note 5)	40		V
V _I	Amplifier Input Voltage	-0.3 to V _{CC} + 0.3		V
V _O	Collector Output Voltage	40		V
I _O	Collector Output Current	250		mA
θ _{JA}	Package Thermal Impedance (Note 6)	M Package	73	°C/W
		P Package	67	
-	Lead Temperature 1.6mm from case for 10 seconds	+260		°C
T _{STG}	Storage Temperature Range	-65 to +150		°C
-	ESD Rating (Machine Model)	200		V

Notes: 4. 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.

5. All voltage values are with respect to the network ground terminal.

6. Maximum power dissipation is a function of T_{J(max)}, θ_{JA} and T_A. The maximum allowable power dissipation at any allowable ambient temperature is P_D = (T_{J(max)} - T_A) / θ_{JA}. Operating at the absolute maximum T_J of +150°C can affect reliability.

Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Unit
V _{CC}	Supply Voltage	7	15	36	V
V _{C1} , V _{C2}	Collector Output Voltage	–	30	36	V
I _{C1} , I _{C2}	Collector Output Current(Each Transistor)	–	–	200	mA
V _I	Amplifier Input Voltage	0.3	–	V _{CC} - 2	V
I _{FB}	Current Into Feedback Terminal	–	–	0.3	mA
I _{REF}	Reference Output Current	–	–	10	mA
C _T	Timing Capacitor	0.00047	0.001	10	μF
R _T	Timing Resistor	1.8	30	500	kΩ
f _{osc}	Oscillator Frequency	1.0	40	200	kHz
–	PWM Input Voltage (Pin 3, 4, 14)	0.3	–	5.3	V
T _A	Operating Free-Air Temperature	-40	–	+85	°C

Electrical Characteristics (T_A=+25°C, V_{CC}=20V, f=10kHz, unless otherwise noted.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Reference Section						
V _{REF}	Output Reference Voltage for AZ494A	I _{REF} =1mA	4.90	4.95	5.0	V
		I _{REF} =1mA, T _A = -40 to +85°C	4.85	4.95	5.05	V
V _{REF}	Output Reference Voltage for AZ494C	I _{REF} =1mA	4.95	5.0	5.05	V
		I _{REF} =1mA, T _A = -40 to +85°C	4.9	5.0	5.1	V
R _{LINE}	Line Regulation	V _{CC} = 7V to 36V	–	2	25	mV
R _{LOAD}	Load Regulation	I _{REF} =1mA to 10mA	–	1	15	mV
I _{SC}	Short-Circuit Output Current	V _{REF} = 0V	10	35	50	mA
Oscillator Section						
f _{osc}	Oscillator Frequency	C _T =0.001μF, R _T =30kΩ	–	40	–	kHz
		C _T =0.01μF, R _T =12kΩ	9.2	10	10.8	
		C _T =0.01μF, R _T =12kΩ T _A = -40 to +85°C	9.0	–	12	
Δf / ΔT	Frequency Change with Temperature	C _T =0.01μF, R _T =12kΩ T _A = -40 to +85°C	–	–	1	%

Electrical Characteristics ($T_A=+25^{\circ}\text{C}$, $V_{CC}=20\text{V}$, $f=10\text{kHz}$ unless otherwise noted.) (Cont.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
Dead-Time Control Section							
I_{BIAS}	Input Bias Current	$V_{CC}=15\text{V}$, $V_{PIN4}=0$ to 5.25V	–	-2	-10	μA	
D(MAX)	Maximum Duty Cycle	$V_{CC}=15\text{V}$, $V_{PIN4}=0\text{V}$, $V_{PIN13}=V_{REF}$	45	–	–	%	
V_{ITH}	Input Threshold Voltage	Zero Duty Cycle	–	3	3.3	V	
		Maximum Duty Cycle	0	–	–		
Error-Amplifier Section							
V_{IO}	Input Offset Voltage	$V_{PIN3}=2.5\text{V}$	–	2	10	mV	
I_{IO}	Input Offset Current	$V_{PIN3}=2.5\text{V}$	–	25	250	nA	
I_{BIAS}	Input Bias Current	$V_{PIN3}=2.5\text{V}$	–	0.2	1	μA	
V_{CM}	Common-Mode Input Voltage Range	$V_{CC}=7\text{V}$ to 36V	-0.3	–	$V_{CC}-2$	V	
G_{VO}	Open-Loop Voltage Gain	$V_O=0.5\text{V}$ to 3.5V	70	95	–	dB	
BW	Unity-Gain Bandwidth	–	–	650	–	kHz	
CMRR	Common-Mode Rejection Ratio	–	65	80	–	dB	
I_{SINK}	Output Sink Current (Feedback)	$V_{ID}=-15\text{mV}$ to -5V , $V_3=0.7\text{V}$	-0.3	-0.7	–	mA	
I_{SOURCE}	Output Source Current (Feedback)	$V_{ID}=15\text{mV}$ to 5V , $V_3=3.5\text{V}$	2	–	–	mA	
PWM Comparator Section							
V_{ITH}	Input Threshold Voltage	Zero duty cycle	–	4	4.5	V	
I_{SINK}	Input Sink Current	$V_3=0.7\text{V}$	-0.3	-0.7	–	mA	
Output Section							
$V_{CE(SAT)}$	Output Saturation Voltage	Common Emitter	$V_E=0\text{V}$, $I_C=200\text{mA}$	–	1.1	1.3	V
$V_{CC(SAT)}$		Emitter Follower	$V_{CC}=15\text{V}$, $I_E=-200\text{mA}$	–	1.5	2.5	
$I_C(OFF)$	Collector Off-State Current	$V_{CE}=36\text{V}$, $V_{CC}=36\text{V}$	–	2	100	μA	
$I_E(OFF)$	Emitter Off-State Current	$V_{CC}=V_C=36\text{V}$, $V_E=0$	–	–	-100	μA	
Total Device							
I_{CC}	Supply Current	$V_{PIN6}=V_{REF}$, $V_{CC}=15\text{V}$	–	6	10	mA	
Output Switching Characteristics							
t_R	Rise Time	Common Emitter Common Collector	–	100	200	ns	
t_F	Fall Time	Common Emitter Common Collector	–	25	100	ns	

Parameter Measurement Information

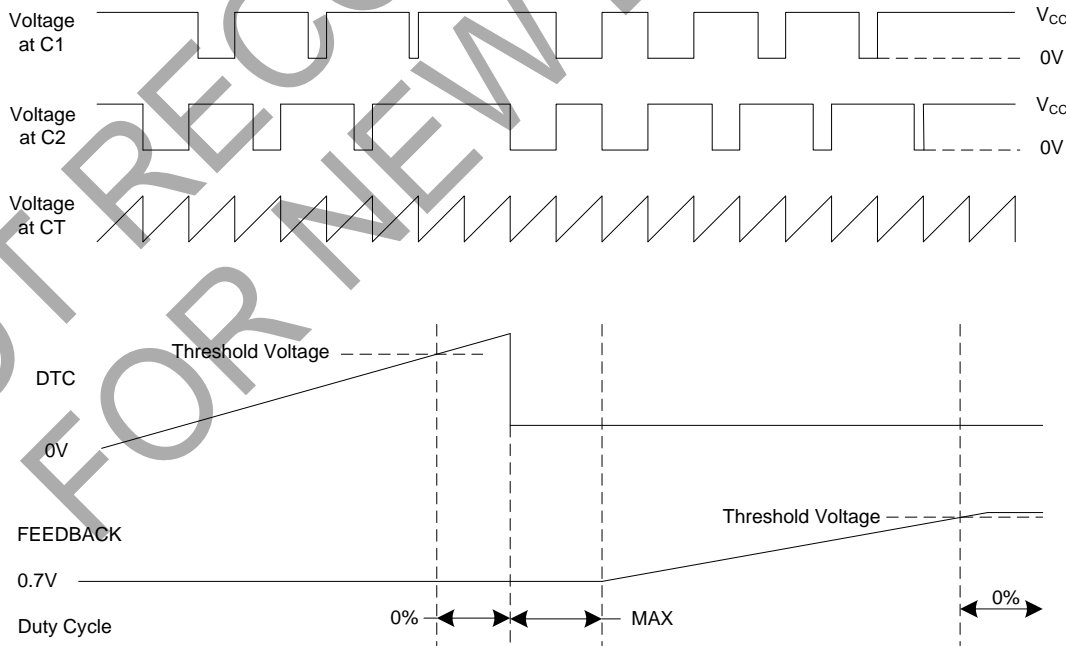
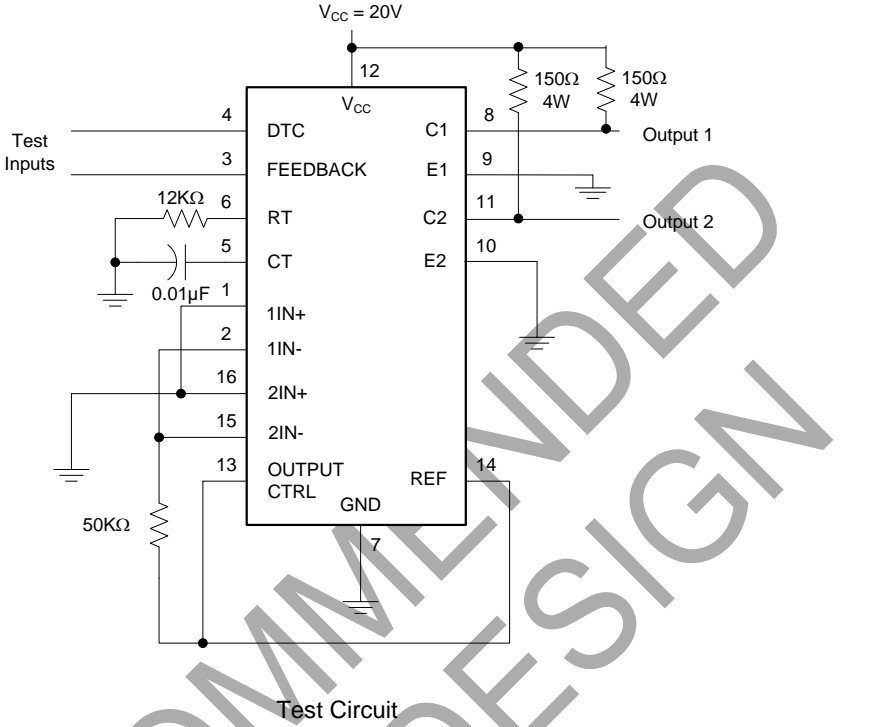


Figure 1. Operational Test Circuit and Waveforms

Parameter Measurement Information (Cont.)

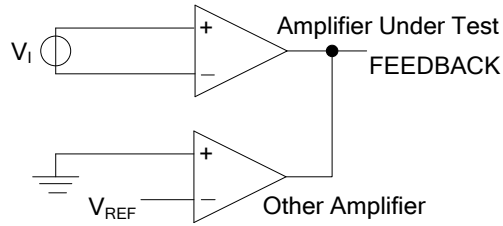
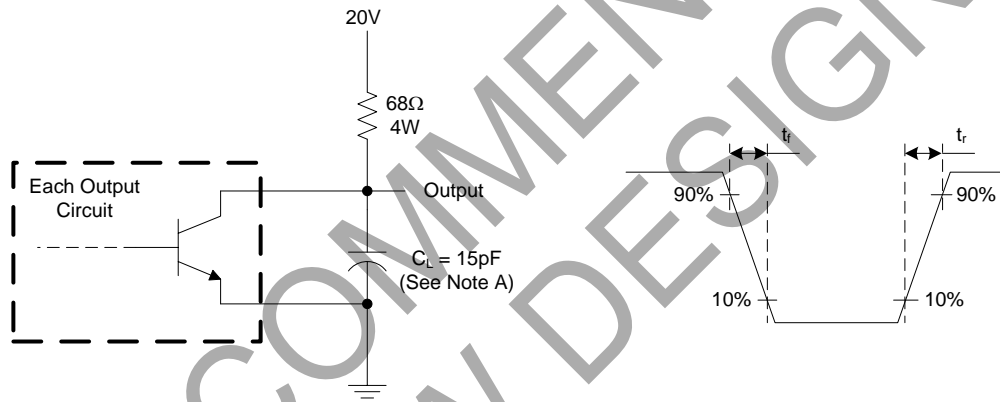
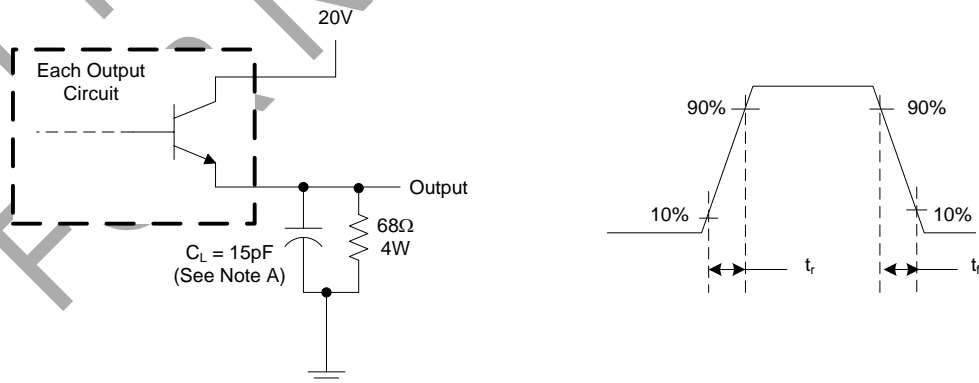


Figure 2. Error Amplifier Characteristics



Note A: C_L includes probe and jig capacitance.

Figure 3. Common-Emitter Configuration

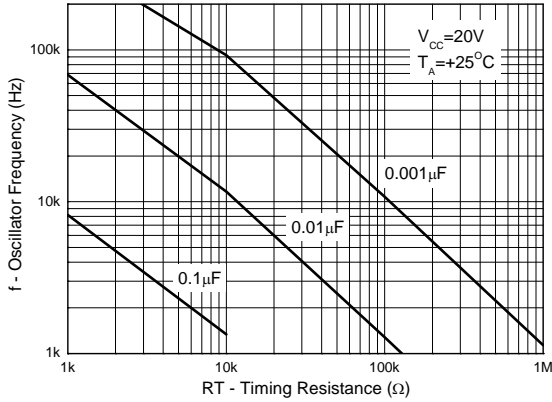


Note A: C_L includes probe and jig capacitance.

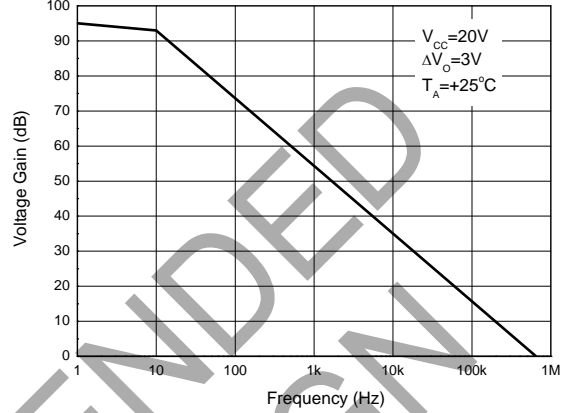
Figure 4. Emitter-Follower Configuration

Performance Characteristics

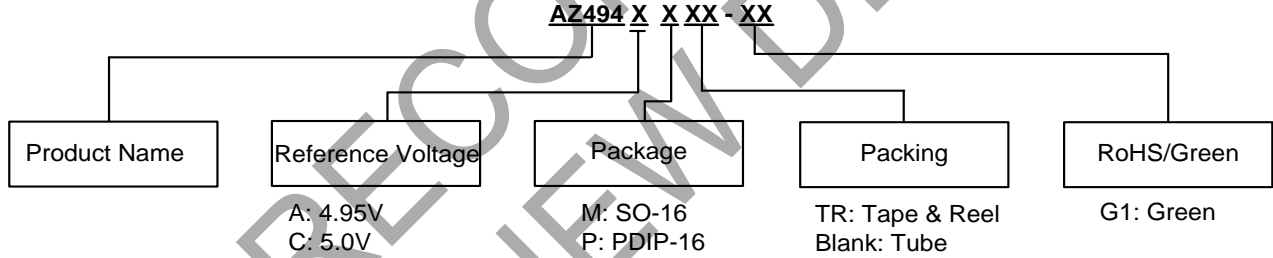
Oscillator Frequency vs. RT and CT



Error Amplifier Small-Signal Voltage Gain vs. Frequency



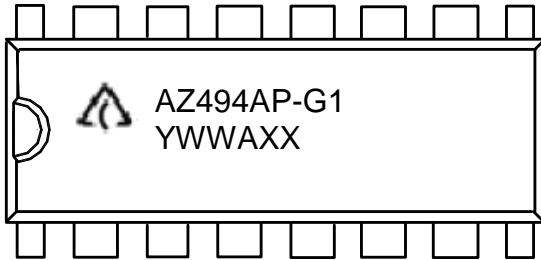
Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing
SO-16	-40 to +85°C	AZ494CMTR-G1	AZ494CM-G1	4000/Tape & Reel
PDIP-16		AZ494AP-G1	AZ494AP-G1	25/Tube

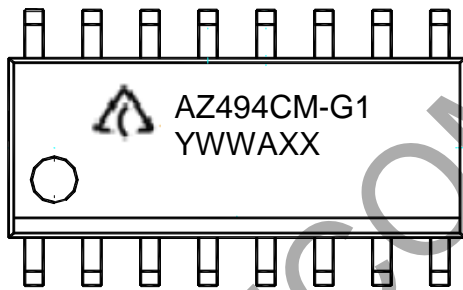
Marking Information

PDIP-16 (Top View)



First Line: Logo and Marking ID
(See Ordering Information)
Second Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: 7th and 8th Digits of Batch No.

SO-16 (Top View)

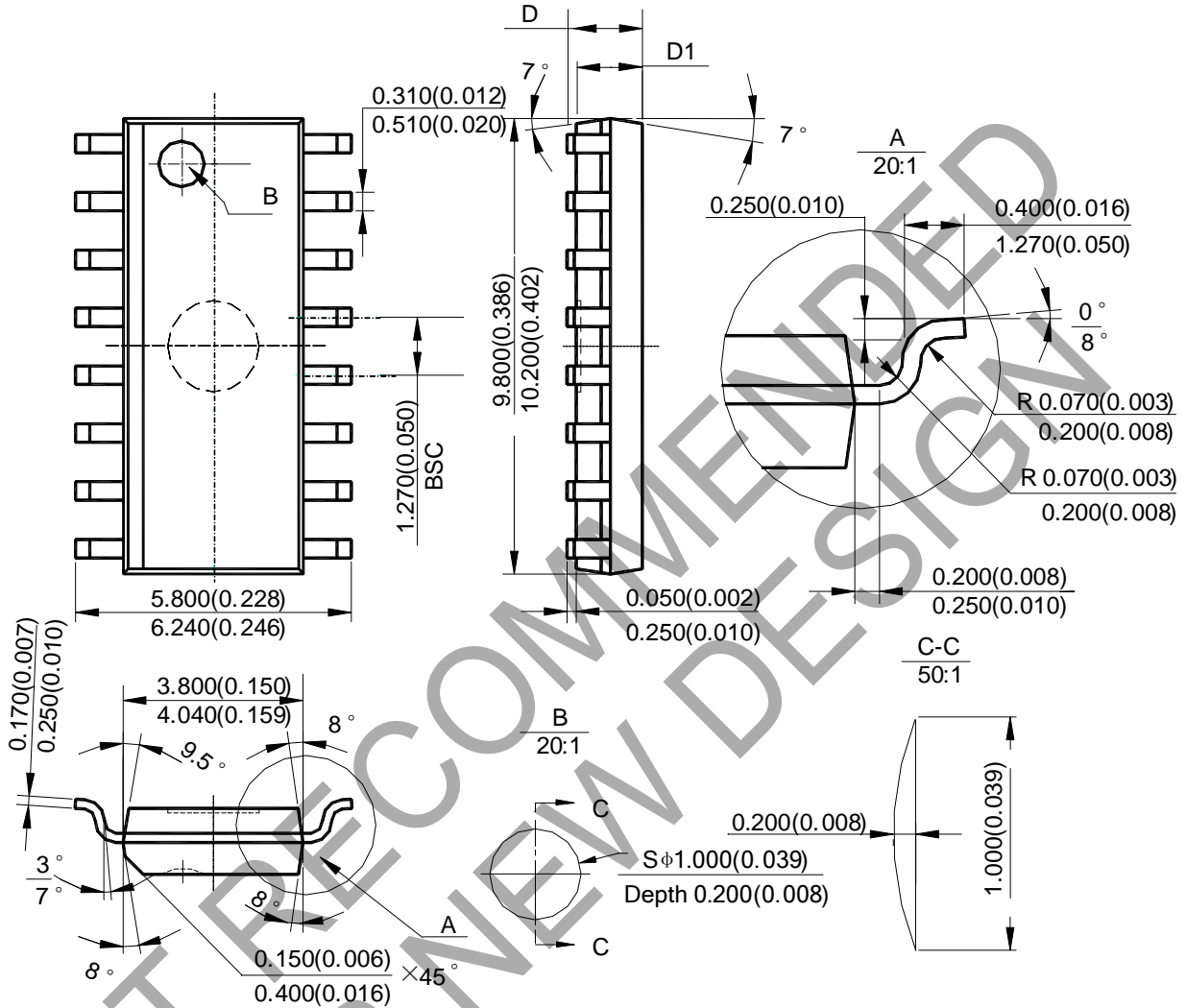


First Line: Logo and Marking ID
(See Ordering Information)
Second Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: 7th and 8th Digits of Batch No.

NOT RECOMMENDED FOR NEW DESIGN

Package Outline Dimensions (All dimensions in mm(inch).)

(1) Package Type: SO-16

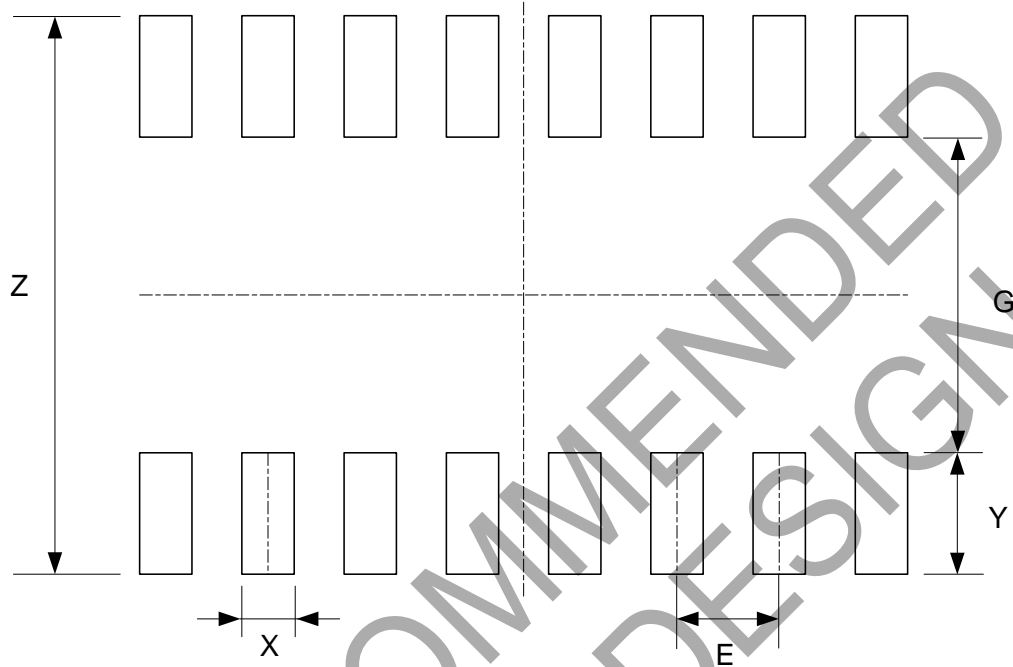


Note: Eject hole, oriented hole and mold mark is optional.

Symbol	D				D1			
	min(mm)	max(mm)	min(inch)	max(inch)	min(mm)	max(mm)	min(inch)	max(inch)
Option1	1.350	1.750	0.053	0.069	1.250	1.650	0.049	0.065
Option2	-	1.260	-	0.050	1.020	-	0.040	-

Suggested Pad Layout

(1) Package Type: SO-16



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	6.900/0.272	3.900/0.154	0.650/0.026	1.500/0.059	1.270/0.050

NOT RECOMMENDED FOR NEW DESIGN

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