PULSE-WIDTH-MODULATION CONTROL CIRCUITS AZ494B/D

General Description

The AZ494B/D is a voltage mode pulse width modulation switching regulator control circuit designed primarily for power supply control.

The AZ494B/D 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 AZ494B/D is capable for push-pull or single-ended output operation, which can be selected through the output control.

AZ494B has 4.95V and AZ494D has 5V reference voltage respectively. The precision of voltage reference (V_{REF}) is improved up to ± 1.5% through trimming and this provides a better output voltage regulation.

The AZ494B/D is available in standard packages of DIP-16 and SOIC-16.

Features

- Stable 4.95V for AZ494B or 5V for AZ494D Reference Voltage Trimmed to ±1.5% 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

Applications

- SMPS
- Back Light Inverter
- Charger

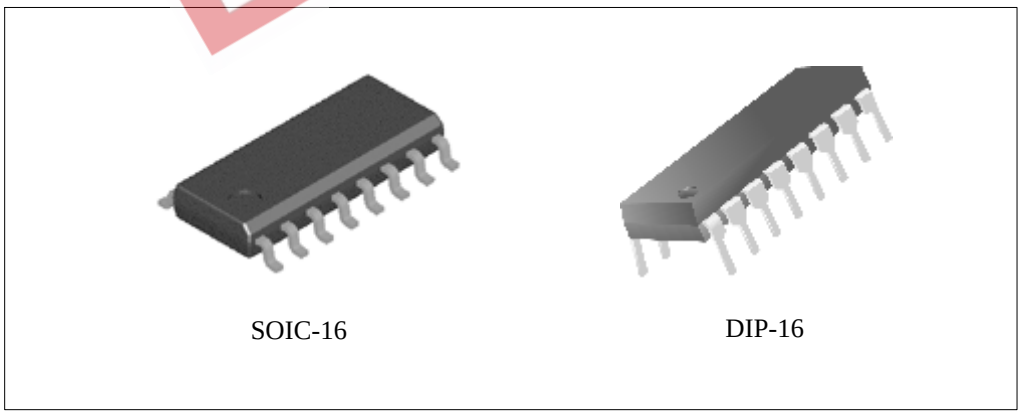


Figure 1. Package Types of AZ494B/D

PULSE-WIDTH-MODULATION CONTROL CIRCUITS AZ494B/D

Pin Configuration

M / P Package
(SOIC-16 / DIP-16)

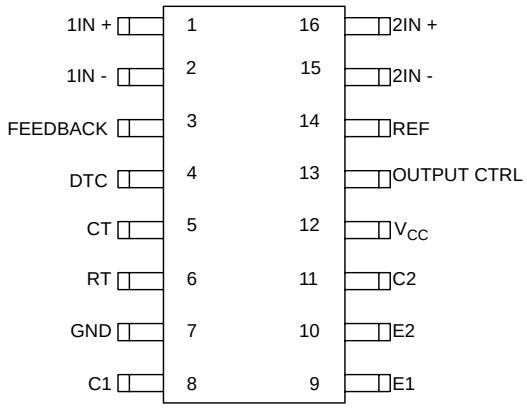


Figure 2. Pin Configuration of AZ494B/D (Top View)

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

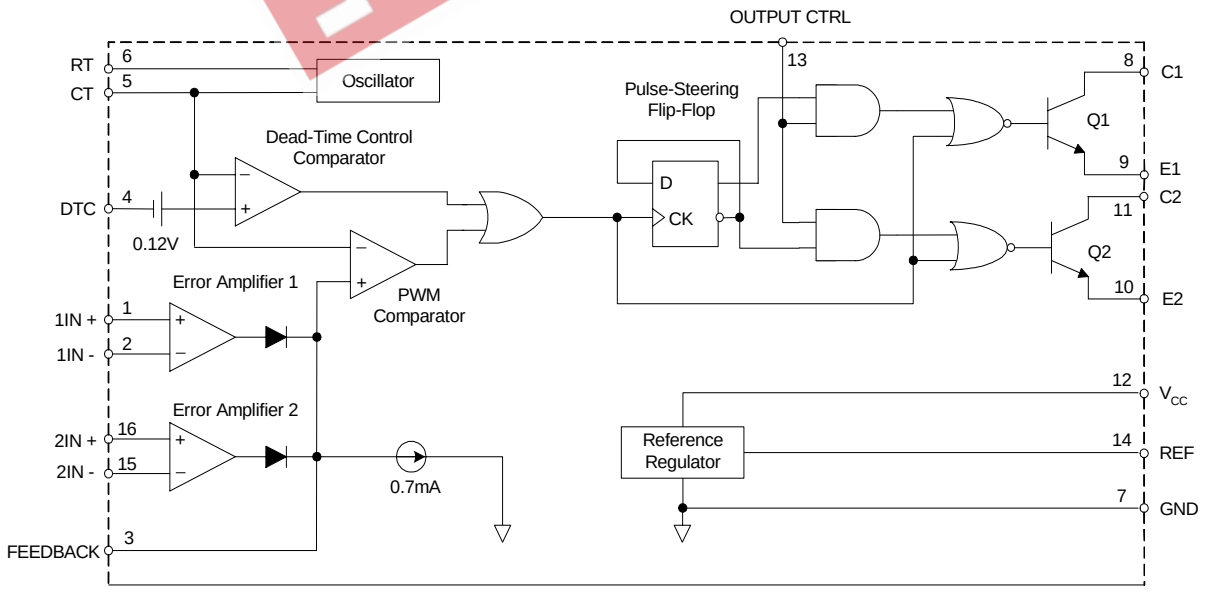
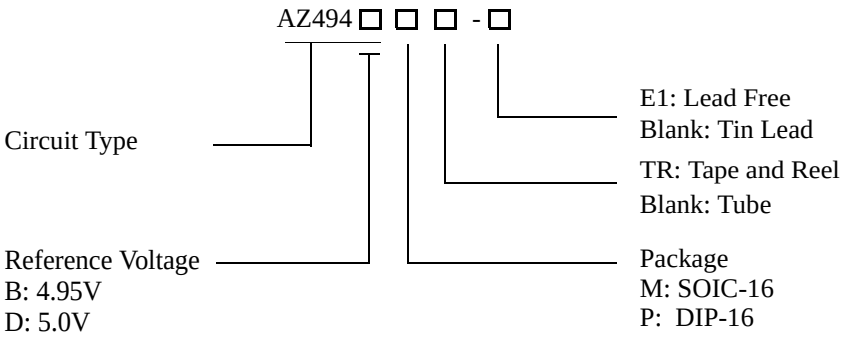


Figure 3. Functional Block Diagram of AZ494B/D

Ordering Information



Package	Temperature Range	Part Number		Marking ID		Packing Type
		Tin Lead	Lead Free	Tin Lead	Lead Free	
SOIC-16	-40 to 85°C	AZ494BM	AZ494BM-E1	AZ494BM	AZ494BM-E1	Tube
		AZ494BMTR	AZ494BMTR-E1	AZ494BM	AZ494BM-E1	Tape & Reel
		AZ494DM	AZ494DM-E1	AZ494DM	AZ494DM-E1	Tube
		AZ494DMTR	AZ494DMTR-E1	AZ494DM	AZ494DM-E1	Tape & Reel
DIP-16		AZ494BP	AZ494BP-E1	AZ494BP	AZ494BP-E1	Tube
		AZ494DP	AZ494DP-E1	AZ494DP	AZ494DP-E1	Tube

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

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	250		mA
Package Thermal Impedance (Note 3)	θ_{JA}	M Package	73	°C/W
		P Package	67	
Lead Temperature 1.6mm from case for 10 seconds		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 $T_J(max)$, θ_{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	Max	Unit
Supply Voltage	V_{CC}	7	36	V
Amplifier Input Voltage	V_I	-0.3	V_{CC} - 2	V
Collector Output Voltage	V_O		36	V
Collector Output Current (Each Transistor)			200	mA
Current Into Feedback Terminal			0.3	mA
Oscillator Frequency	f_{osc}		300	KHz
Timing Capacitor	C_T	0.47	10000	nF
Timing Resistor	R_T	1.8	500	KΩ
Operating Free-Air Temperature	T_A	-40	85	°C
Reference Output Current	I_{REF}		10	mA

Electrical Characteristics

T_A = 25°C, V_{CC}=15V, f=10KHz unless otherwise noted.

Parameter		Symbol	Conditions (Note 4)	Min	Typ	Max	Unit
Reference Section							
Output Reference Voltage	for AZ494B	V_{REF}	I_{REF}=1mA	4.875	4.95	5.025	V
	for AZ494D	V_{REF}	I_{REF}=1mA	4.925	5.0	5.075	V
Line Regulation		R_{LINE}	V_{CC} = 7V to 36V		2	25	mV
Load Regulation		R_{LOAD}	I_{REF}=1mA to 10mA		1	15	mV
Short-Circuit Output Current(Note 5)		I_{SC}	V_{REF} = 0V		25		mA
Oscillator Section, C_T = 0.01μF, R_T = 12KΩ (See Figure 4)							
Frequency		f_{osc}			10		KHz
Standard Deviation of Frequency (Note 6)			All values of V_{CC}, C_T, R_T and T_A constant		100		Hz/KHz
Frequency Change with Voltage			V_{CC}=7V to 36V, T_A = 25°C		1		Hz/KHz
Frequency Change with Temperature (Note 7)			ΔT_A= MIN to MAX			10	Hz/KHz
Error-Amplifier Section							
Input Offset Voltage		V_{IO}	V_O (FEEDBACK) = 2.5V		2	10	mV
Input Offset Current		I_{IO}	V_O (FEEDBACK) = 2.5V		25	250	nA
Input Bias Current		I_{BIAS}	V_O (FEEDBACK) = 2.5V		0.2	1	μA
Common-Mode Input Voltage Range		V_{CM}	V_{CC}=7V to 36V	-0.3		V_{CC}-2	V
Large-Signal Open-Loop Voltage Gain		A_{VO}	ΔV_O = 3V, R_L =2KΩ, V_O =0.5V to 3.5V	70	95		dB
Unity-Gain Bandwidth		GB			800		KHz
Common-Mode Rejection Ratio		CMRR	V_{CC}=7V to 36V	65	80		dB
Output Sink Current (FEEDBACK)		I_{SINK}	V_{ID} = -15mV to -5V, V(FEEDBACK) = 0.7V	- 0.3	- 0.7		mA
Output Source Current (FEEDBACK)		I_{SOURCE}	V_{ID} = 15mV to 5V, V(FEEDBACK) = 3.5V	2			mA
Output Section							
Collector Off-State Current		$I_{C, OFF}$	V_{CE} = 36V, V_{CC}=36V		2	100	μA
Emitter Off-State Current		$I_{E, OFF}$	V_{CC} = V_C = 36V, V_E = 0			-100	μA
Collector-Emitter Saturation Voltage	Common Emitter		V_E = 0, I_C =200mA		1.1	1.3	V
	Emitter Follower		V_O (C1 or C2) = 15V, I_E = -200mA		1.5	2.5	

Electrical Characteristics (Continued)

Parameter	Symbol	Conditions (Note 4)	Min	Typ	Max	Unit
Output Control Input Current		$V_I = V_{REF}$			3.5	mA
Dead-Time Control Section						
Input Bias Current		V_I = 0 to 5.25V		-2	-10	μA
Maximum Duty Cycle, Each Output		V_I (DEAD-TIME CTRL) = 0, C_T =0.01μF, R_T =12KΩ		45		%
Input Threshold Voltage		Zero Duty Cycle		3	3.3	V
		Maximum Duty Cycle	0			
PWM Comparator Section (See Figure 4)						
Input Threshold Voltage (FEEDBACK)		Zero duty cycle		4	4.5	V
Input Sink Current (FEEDBACK)		V(FEEDBACK) = 0.7V	-0.3	-0.7		mA
Total Device						
Standby Supply Current	I_{STDBY}	V_{RT}=V_{REF}, All other inputs and outputs open; V_{CC} = 15V		6	10	mA
		V_{CC} = 36V		9	15	
Average Supply Current		V_I (DEAD-TIME-CTRL) =2V See Figure 4.		7.5		mA
Switching Characteristics						
Rise Time	t_r	Common-emitter Configuration See Figure 6		100	200	ns
Fall Time	t_f			25	100	ns
Rise Time	t_r	Emitter-follower Configuration See Figure 7		100	200	ns
Fall Time	t_f			40	100	ns

Note 4: For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
Note 5: Duration of the short circuit should not exceed one second.
Note 6: Standard deviation is a measure of the statistical distribution about the mean as derived from the formula:

$$\sigma = \sqrt{\frac{\sum_{n=1}^{N} (X_n - \bar{X})^2}{N-1}}$$

Note 7: Temperature coefficient of timing capacitor and timing resistor are not taken into account.

Parametr Measurement information

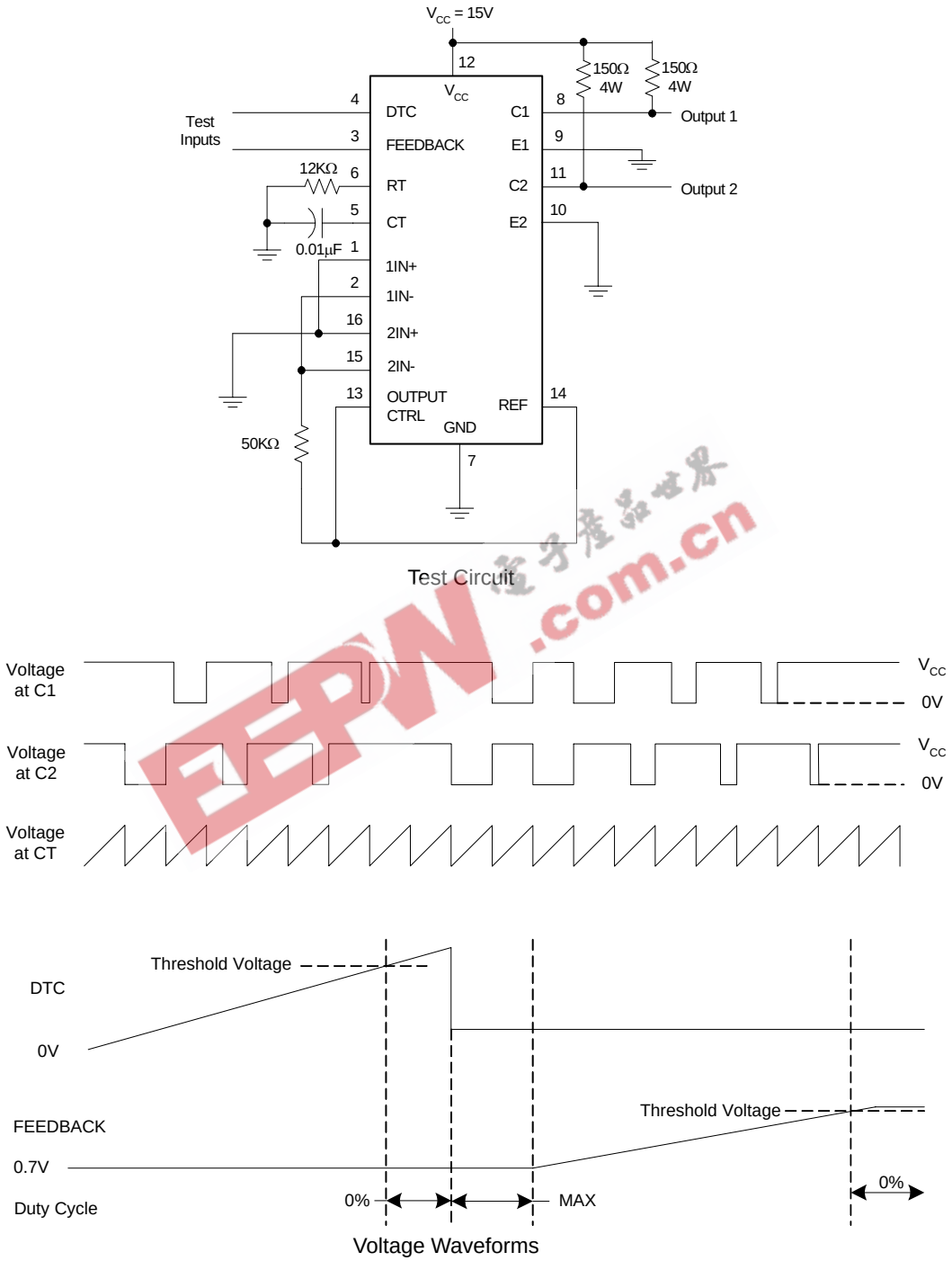


Figure 4. Operational Test Circuit and Waveforms

Parametr Measurement information (Continued)

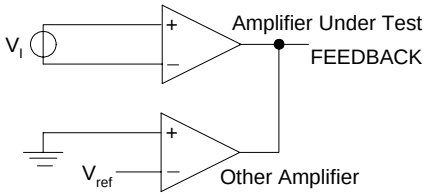
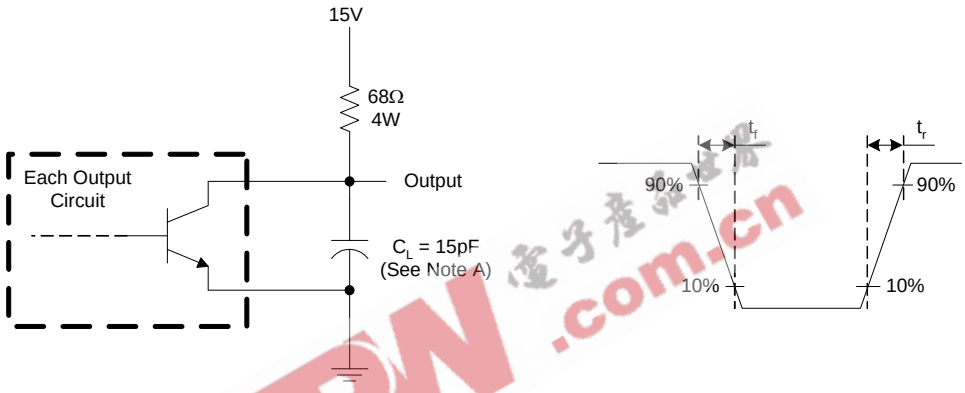
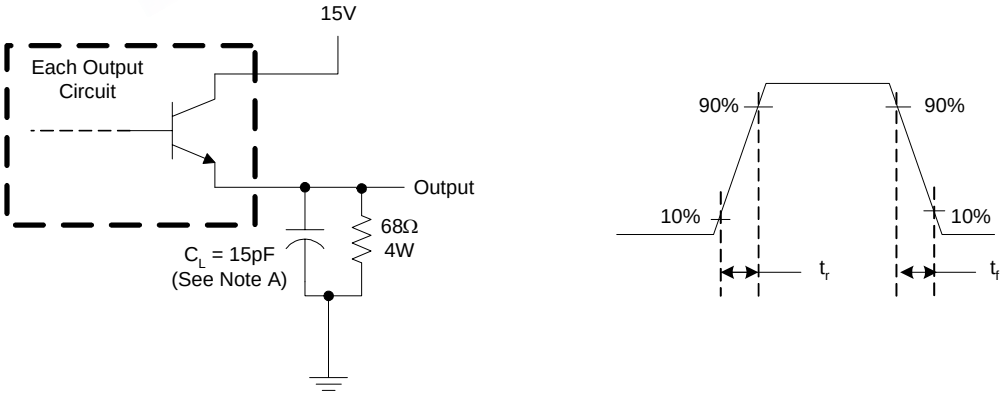


Figure 5. Error Amplifier Characteristics



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

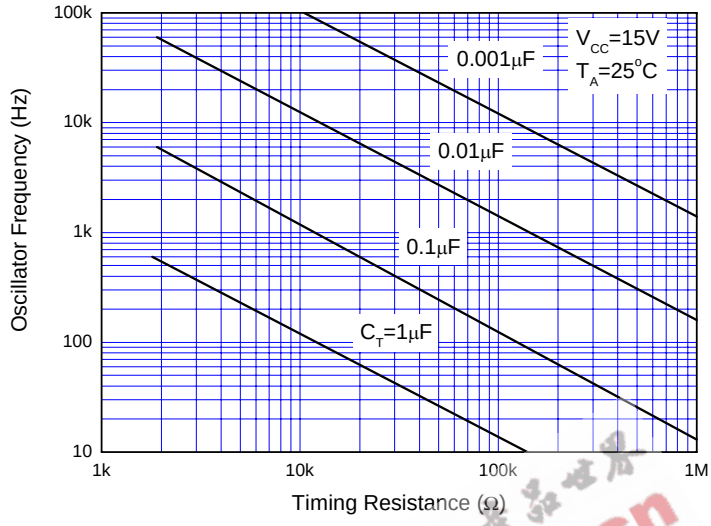


Figure 8. Oscillator Frequency vs. R_T and C_T

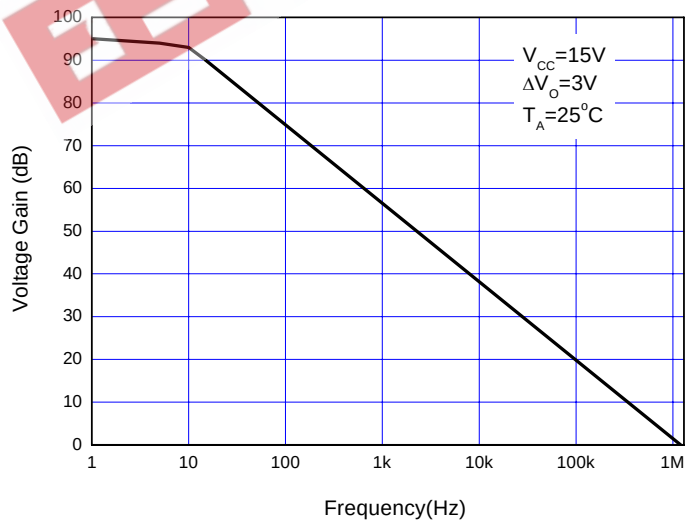
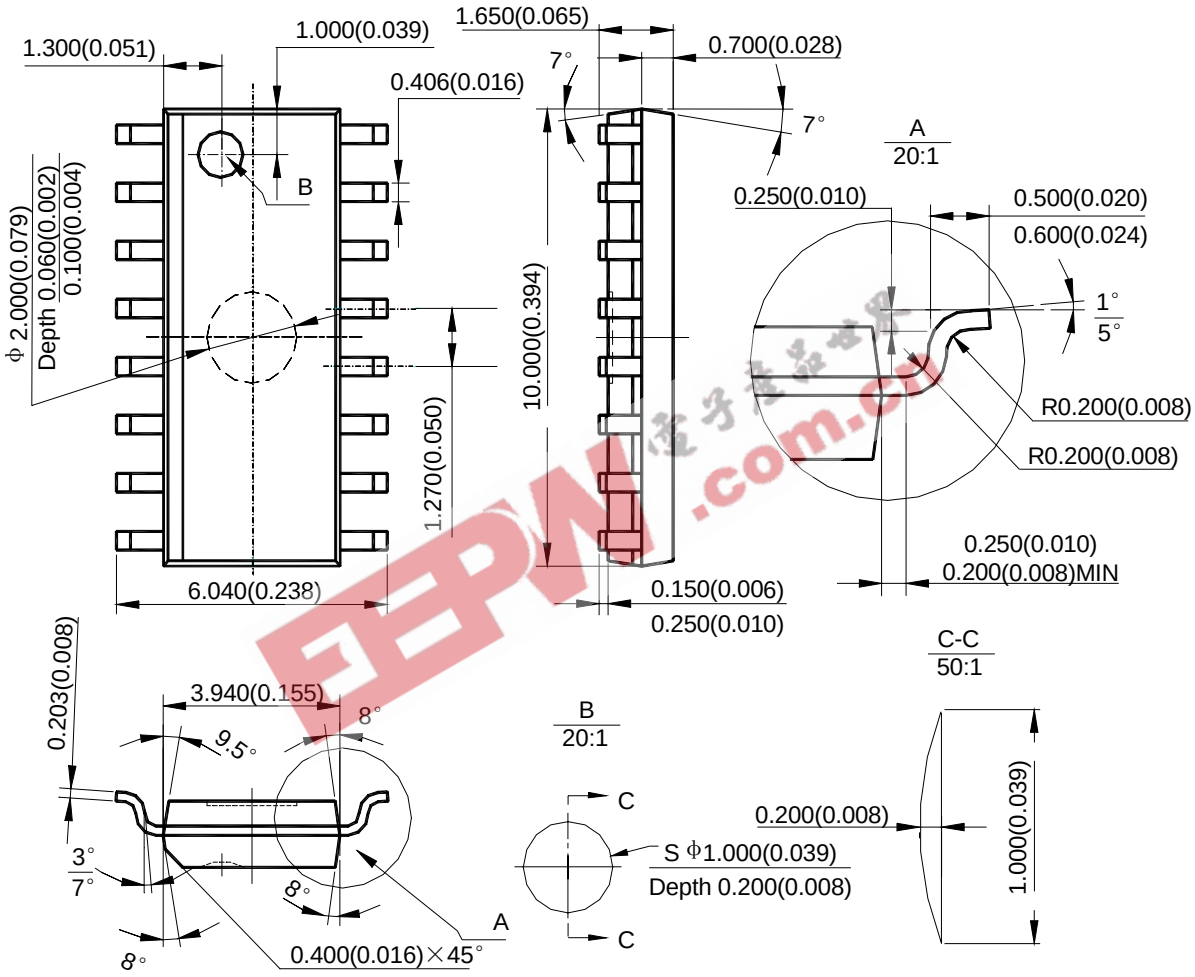


Figure 9. Error Amplifier Small-Signal Voltage Gain vs. Frequency

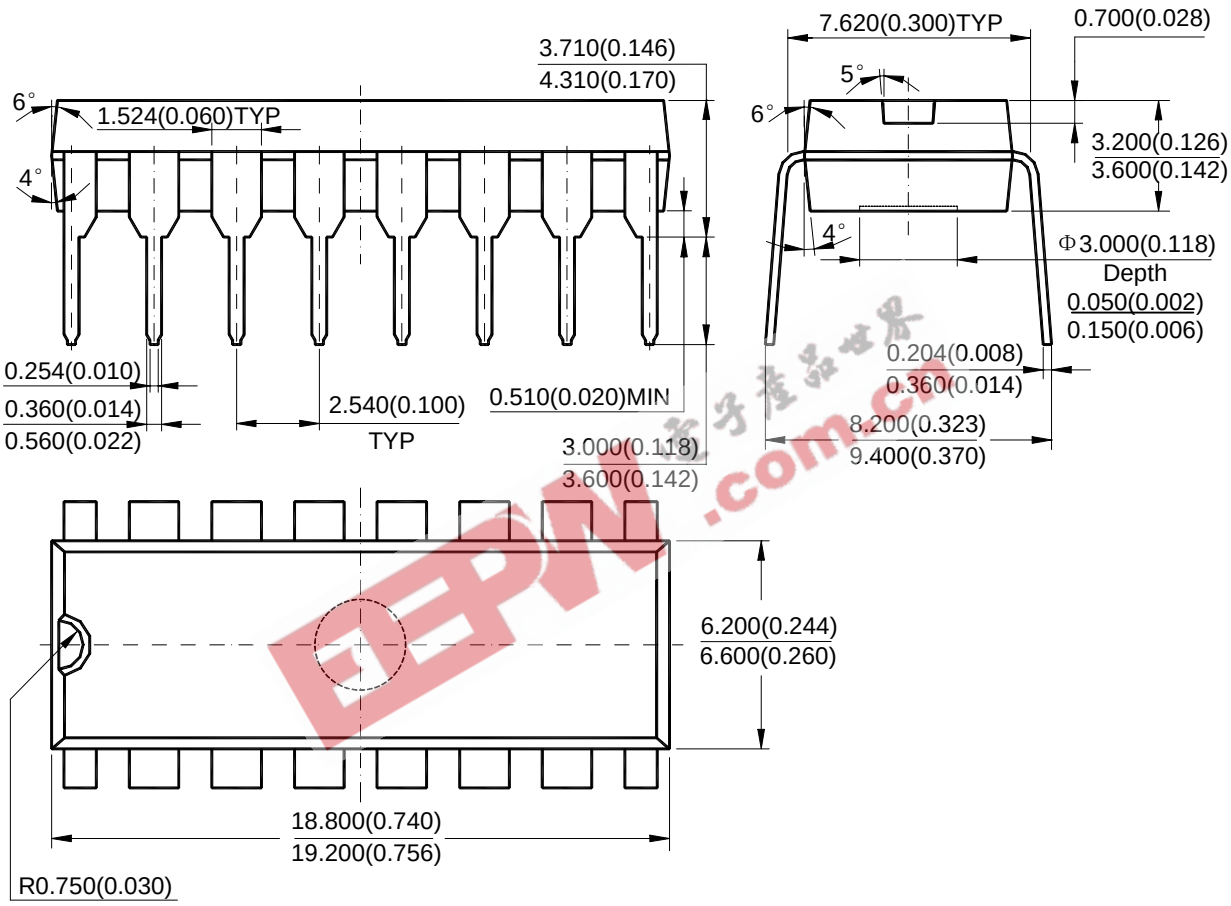
Mechanical Dimensions

SOIC-16 **Unit: mm(inch)**



Mechanical Dimensions (Continued)

DIP-16 **Unit: mm(inch)**



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