LOW POWER DUAL OPERATIONAL AMPLIFIERS AZ358/358C

General Description

The AZ358/358C consists of two independent, high gain and internally frequency compensated operational amplifiers, it is specifically designed to operate from a single power supply. Operation from split power supply is also possible and the low power supply current drain is independent of the magnitude of the power supply voltages.

The AZ358/358C series are Compatible with Industry standard 358. AZ358C has more stringent input offset voltage than AZ358.

The AZ358/358C series are available in standard packages of DIP-8 and SOIC-8.

Features

- Internally Frequency Compensated for Unity Gain
- Large Voltage Gain: 100dB (Typical)
- Low Input Bias Current: 20nA (Typical)
- Low Input Offset Voltage: 2mV (Typical)
- Low Supply Current: 0.5mA (Typical)
- Wide Power Supply Voltage Range:
  Single Supply: 3V to 18V
  Dual Supplies: ±1.5V to ±9V
- Input Common Mode Voltage Range Includes Ground
- Large Output Voltage Swing: 0V to V_{CC}-1.5V
- Power Drain Suitable for Battery Operation

Applications

- Battery Charger
- Cordless Telephone
- Switching Power Supply

Figure 1. Package Types of AZ358/358C

Pin Configuration

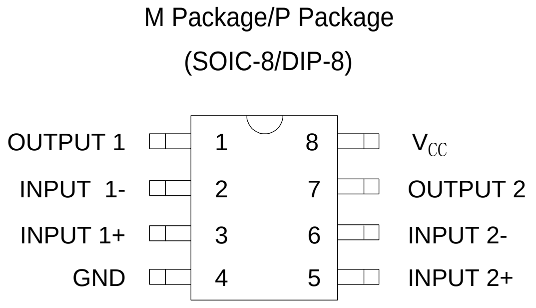


Figure 2. Pin Configuration of AZ358/358C (Top View)

Functional Block Diagram

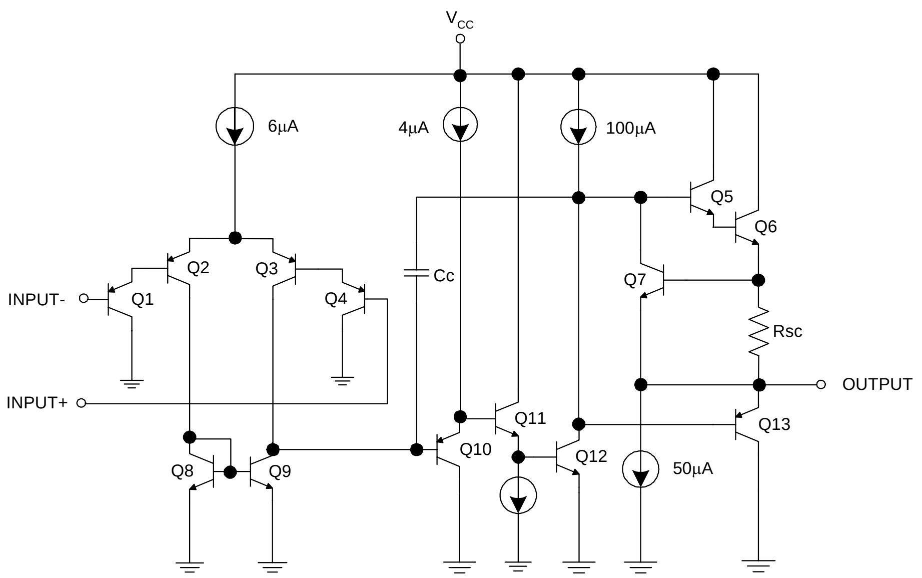
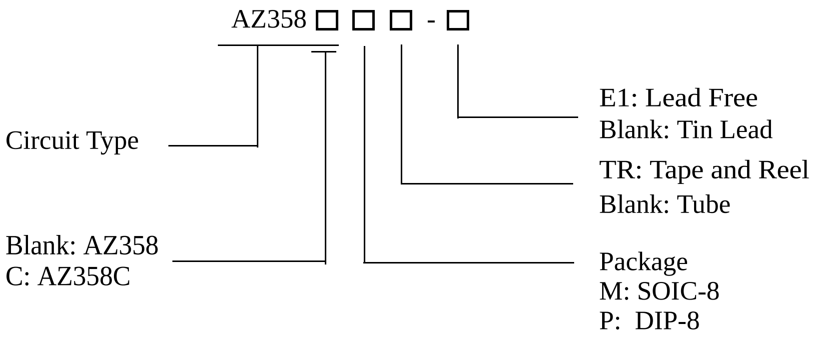


Figure 3. Functional Block Diagram of AZ358/358C (Each Amplifier)

Ordering Information



Package	Input Offset Voltage		Part Number		Marking ID		Packing Type
			Tin Lead	Lead Free	Tin Lead	Lead Free	
SOIC-8	Maximum Value	5mV	AZ358M	AZ358M-E1	AZ358M	AZ358M-E1	Tube
		5mV	AZ358MTR	AZ358MTR-E1	AZ358M	AZ358M-E1	Tape & Reel
		3mV	AZ358CM	AZ358CM-E1	358CM	358CM-E1	Tube
		3mV	AZ358CMTR	AZ358CMTR-E1	358CM	358CM-E1	Tape & Reel
DIP-8	Maximum Value	5mV	AZ358P	AZ358P-E1	AZ358P	AZ358P-E1	Tube
		3mV	AZ358CP	AZ358CP-E1	AZ358CP	AZ358CP-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
Power Supply Voltage	V_{CC}	20		V
Differential Input Voltage	V_{ID}	20		V
Input Voltage	V_{IC}	-0.3 to 20		V
Input Current (V_{IN}<-0.3V) (Note 2)	I_{IN}	50		mA
Output Short Circuit to Ground (One Amplifier) (Note 3) $V_{CC} \leq 12V$ and $T_A = 25^oC$		Continuous		
Power Dissipation ($T_A=25^oC$)	P_D	DIP-8	830	mW
		SOIC-8	550	
Operating Junction Temperature	T_J	150		^oC
Storage Temperature Range	T_{STG}	-65 to 150		^oC
Lead Temperature (Soldering, 10 Seconds)	T_{LEAD}	260		^oC

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 under these conditions is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.
Note 2: This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is also lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the op amps to go to the V_{CC} voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than -0.3V (at 25^oC)
Note 3: Short circuits from the output to V_{CC} can cause excessive heating and eventual destruction. When considering short circuits to ground, the maximum output current is approximately 40mA independent of the magnitude of V_{CC}. At values of supply voltage in excess of +12V, continuous short circuits can exceed the power dissipation ratings and cause eventual destruction. Destructive dissipation can result from simultaneous shorts on all amplifiers.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	3	18	V
Ambient Operating Temperature Range	T_A	-40	85	^oC

Electrical Characteristics

V_{CC}=5V, GND=0, T_A=25°C unless otherwise specified.

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	V_O=1.4V, R_S=0Ω, V_{CC}=5V to 15V	AZ358		2	5	mV
			AZ358C		2	3	
Input Bias Current (Note 4)	I_{BIAS}	I_{IN}+ or I_{IN}-, V_{CM}=0V			20	200	nA
Input Offset Current	I_{IO}	I_{IN}+-I_{IN}-, V_{CM}=0V			5	50	nA
Input Common Mode Voltage Range (Note 5)	V_{IR}	V_{CC}=15V		0		V_{CC}-1.5	V
Supply Current	I_{CC}	R_L=∞, Over full temperature range on all OP Amps	V_{CC}=15V		0.7	1.5	mA
			V_{CC}=5V		0.5	1.2	
Large Signal Voltage Gain	G_V	V_{CC}=15V, R_L≥2KΩ, V_O=1V to 11V		85	100		dB
Common Mode Rejection Ratio	CMRR	V_{CM}=0V to (V_{CC}-1.5)V		70	90		dB
Power Supply Rejection Ration	PSRR	V_{CC}=5V to 15V		70	90		dB
Channel Separation (Note 6)	CS	f=1KHz to 20KHz			-120		dB
Output Current — Source	I_{SOURCE}	V_{IN}+=1V, V_{IN}-=0V, V_{CC}=15V, V_O=2V		20	40		mA
Output Current — Sink	I_{SINK}	V_{IN}+=0V, V_{IN}-=1V, V_{CC}=15V, V_O=2V		10	18		mA
		V_{IN}+=0V, V_{IN}-=1V, V_{CC}=15V, V_O=0.2V		12	50		μA
Output Short Circuit to Ground	I_{SC}	V_{CC}=15V			40	60	mA
Output Voltage Swing	V_{OH}	V_{CC}=15V, R_L=2KΩ		12			V
		V_{CC}=15V, R_L=10KΩ		12.5	13.5		
	V_{OL}	V_{CC}=5V, R_L=10KΩ			5	20	mV

Note 4: The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the input lines.

Note 5: The input common-mode voltage of either input signal voltage should not be allowed to go negatively by more than 0.3V (at 25°C). The upper end of the common-mode voltage range is V_{CC}-1.5V (at 25°C), but either or both inputs can go to +18V without damages, independent of the magnitude of the V_{CC}.

Note 6: Due to proximity of external components, insure that coupling is not originating via stray capacitors between these external parts. This typically can be detected as this type of capacitance increases at higher frequencies.

Typical Performance Characteristics

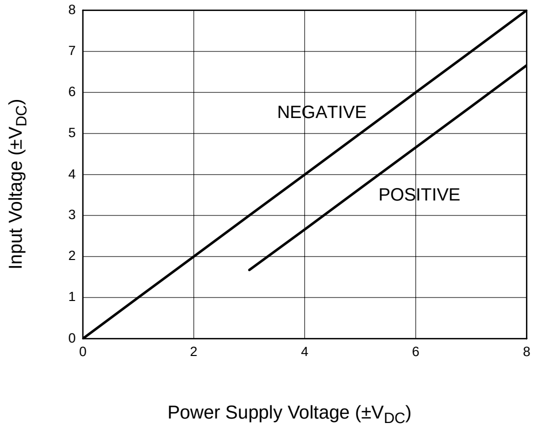


Figure 4. Input Voltage Range

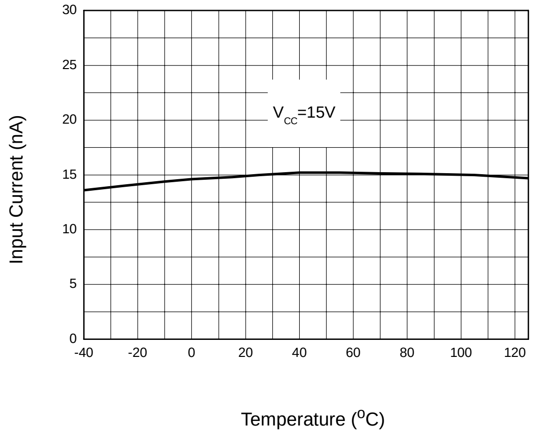


Figure 5. Input Current

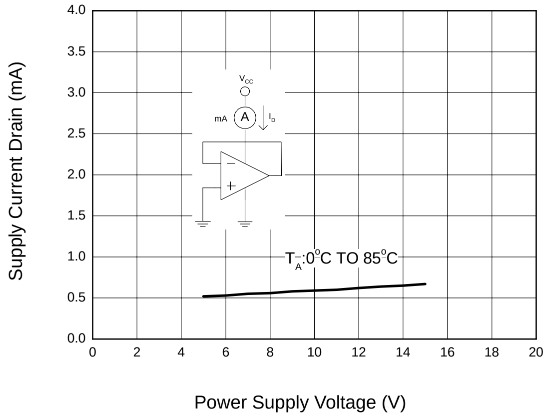


Figure 6. Supply Current

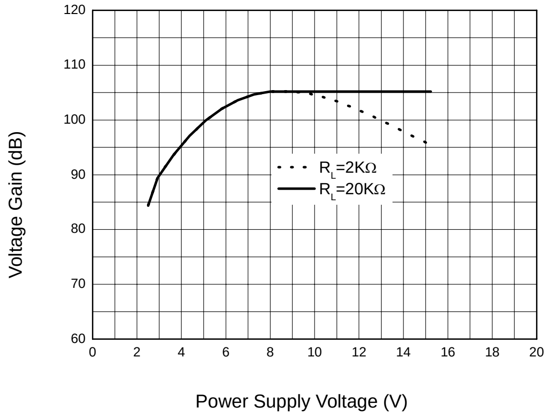


Figure 7. Voltage Gain

Typical Performance Characteristics (Continued)

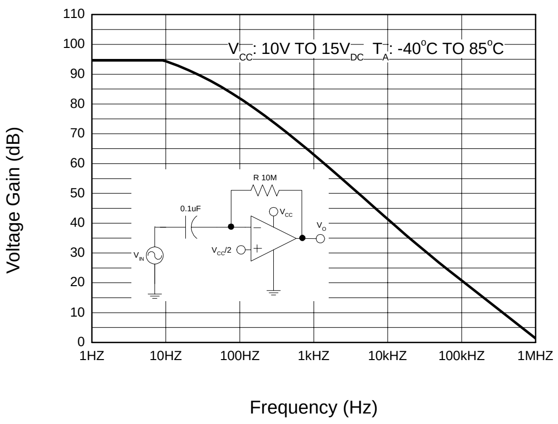


Figure 8. Open Loop Frequency Response

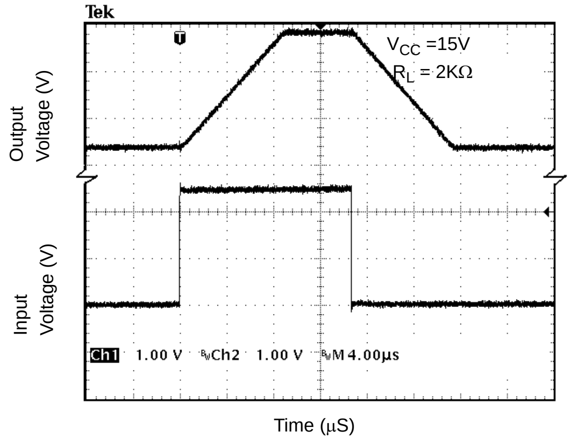


Figure 9. Voltage Follower Pulse Response

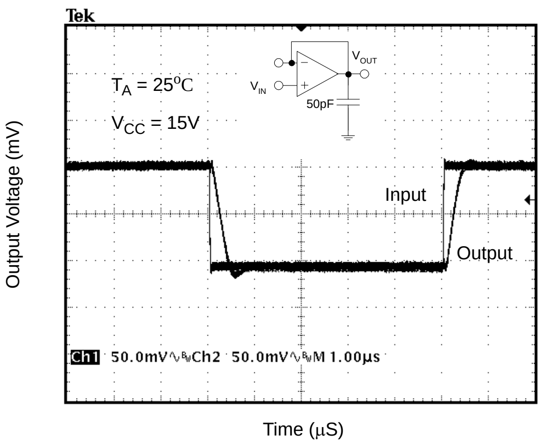


Figure 10. Voltage Follower Pulse Response (Small Signal)

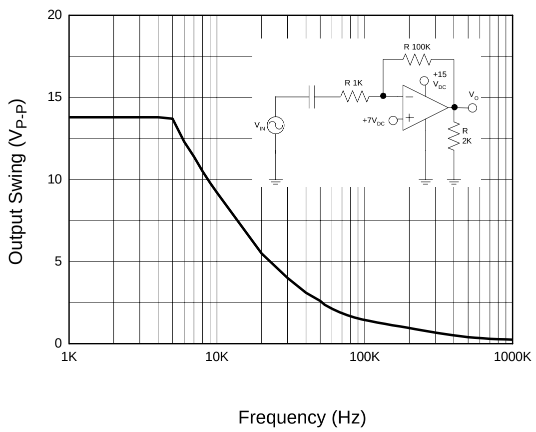


Figure 11. Large Signal Frequency Response

Typical Performance Characteristics (Continued)

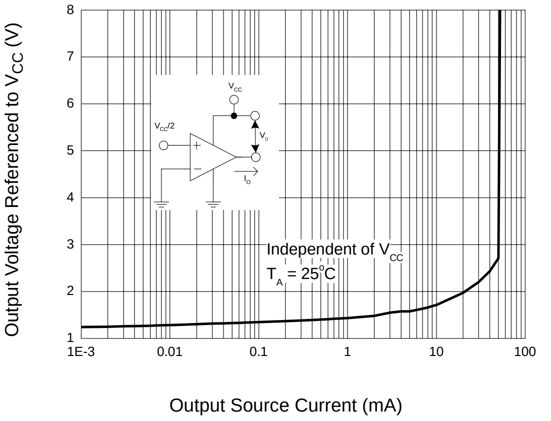


Figure 12. Output Characteristics Current Sourcing

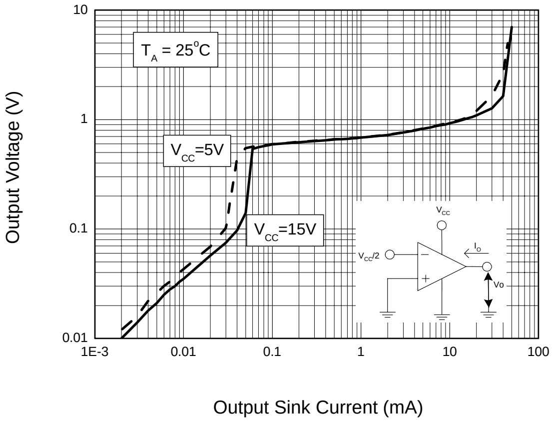


Figure 13. Output Characteristics Current Sinking

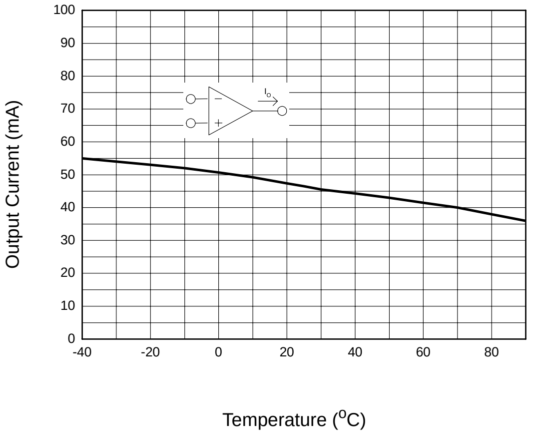


Figure 14. Current Limiting

Typical Application

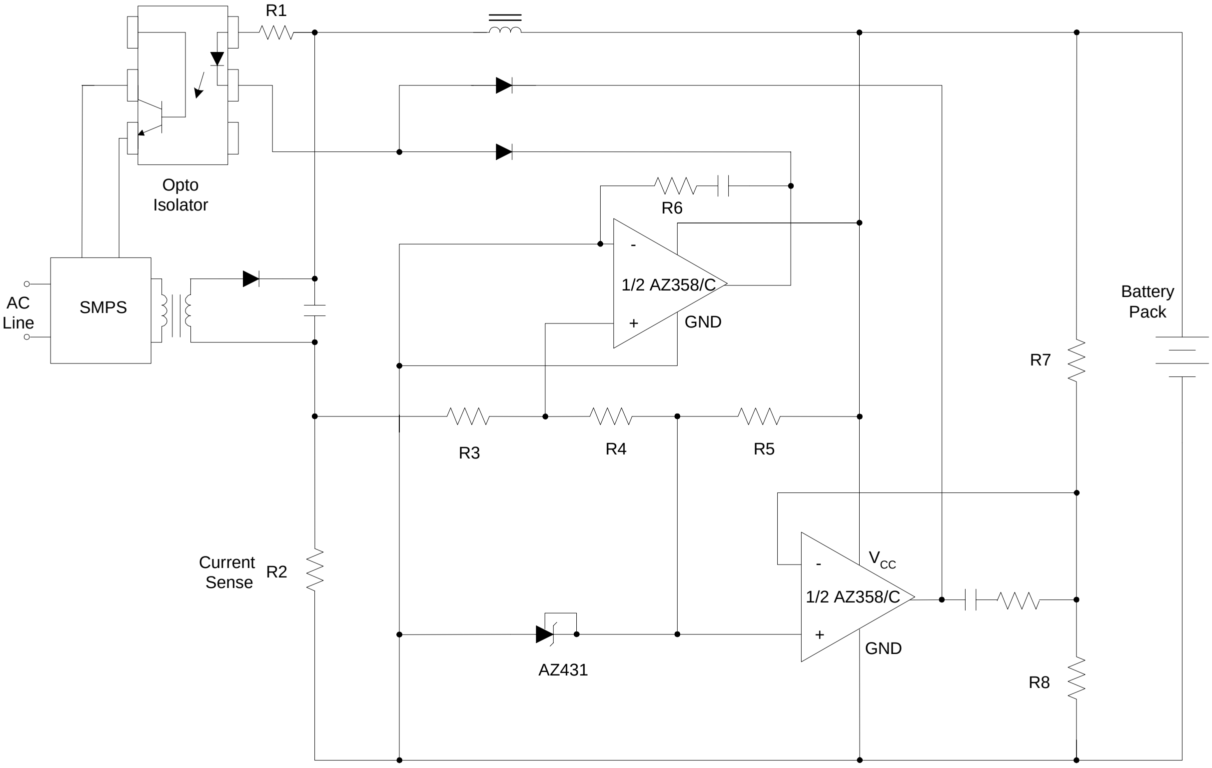


Figure 15. Battery Charger

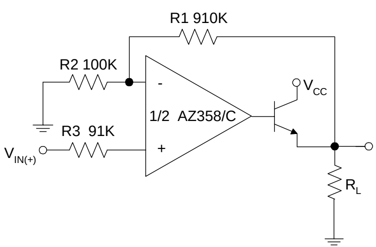


Figure 16. Power Amplifier

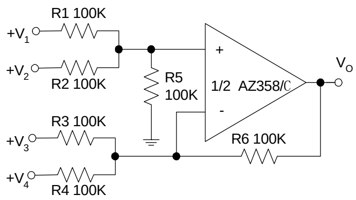


Figure 17. DC Summing Amplifier

Typical Application (Continued)

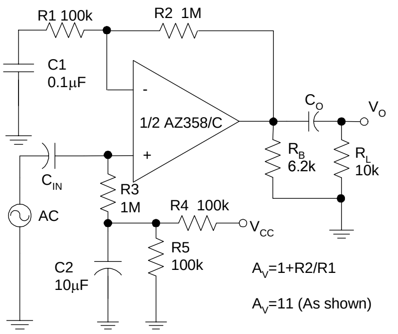


Figure 18. AC Coupled Non-Inverting Amplifier

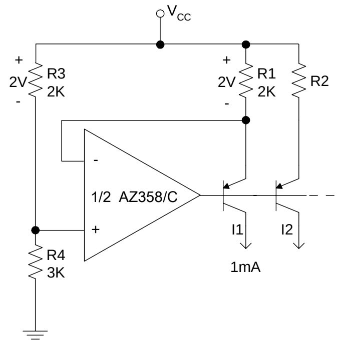


Figure 19. Fixed Current Sources

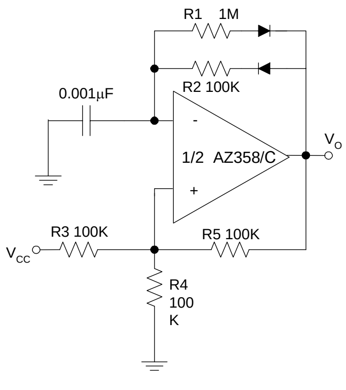


Figure 20. Pulse Generator

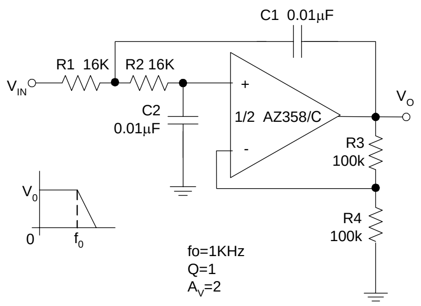
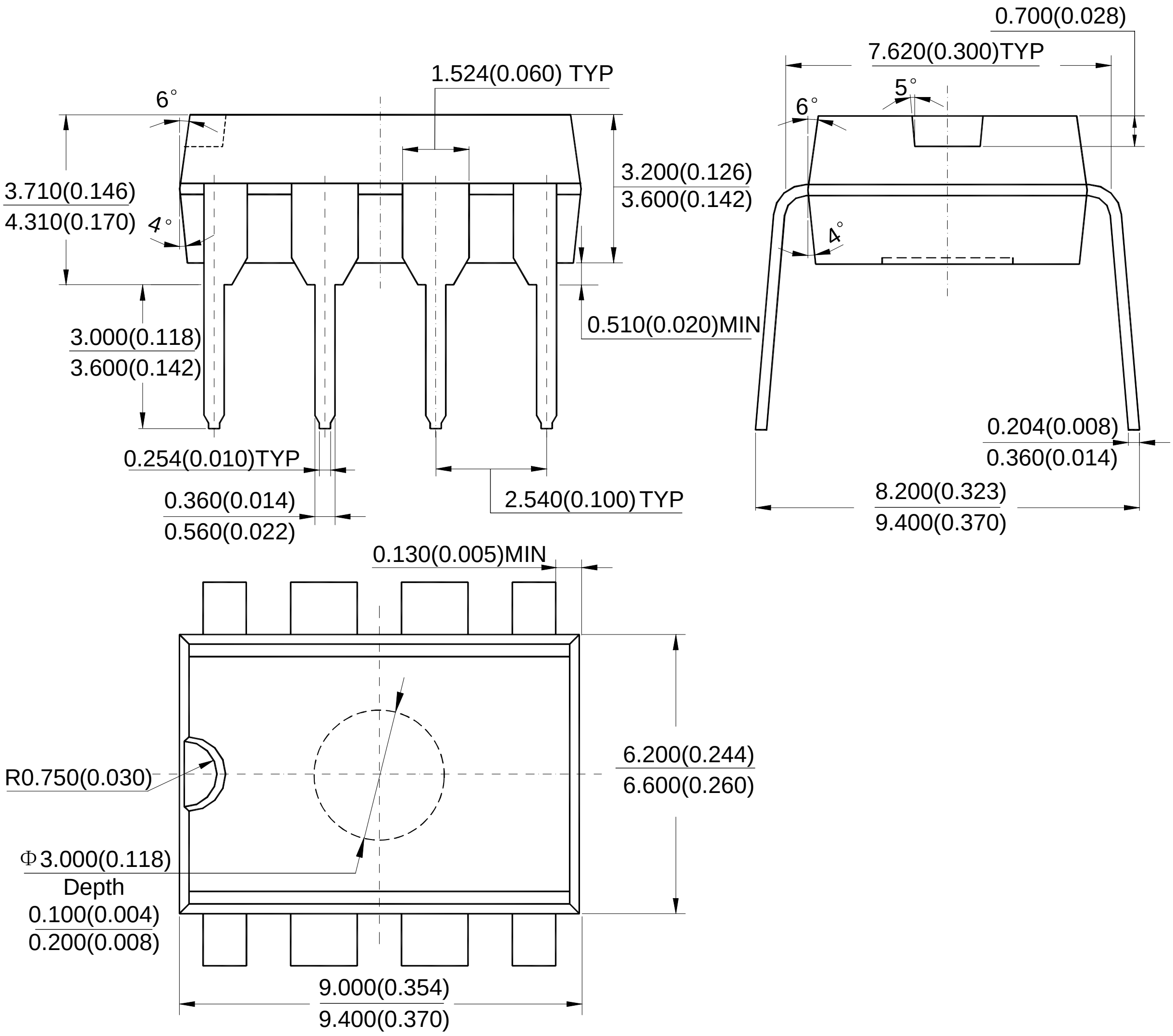


Figure 21. DC Coupled Low-Pass Active Filter

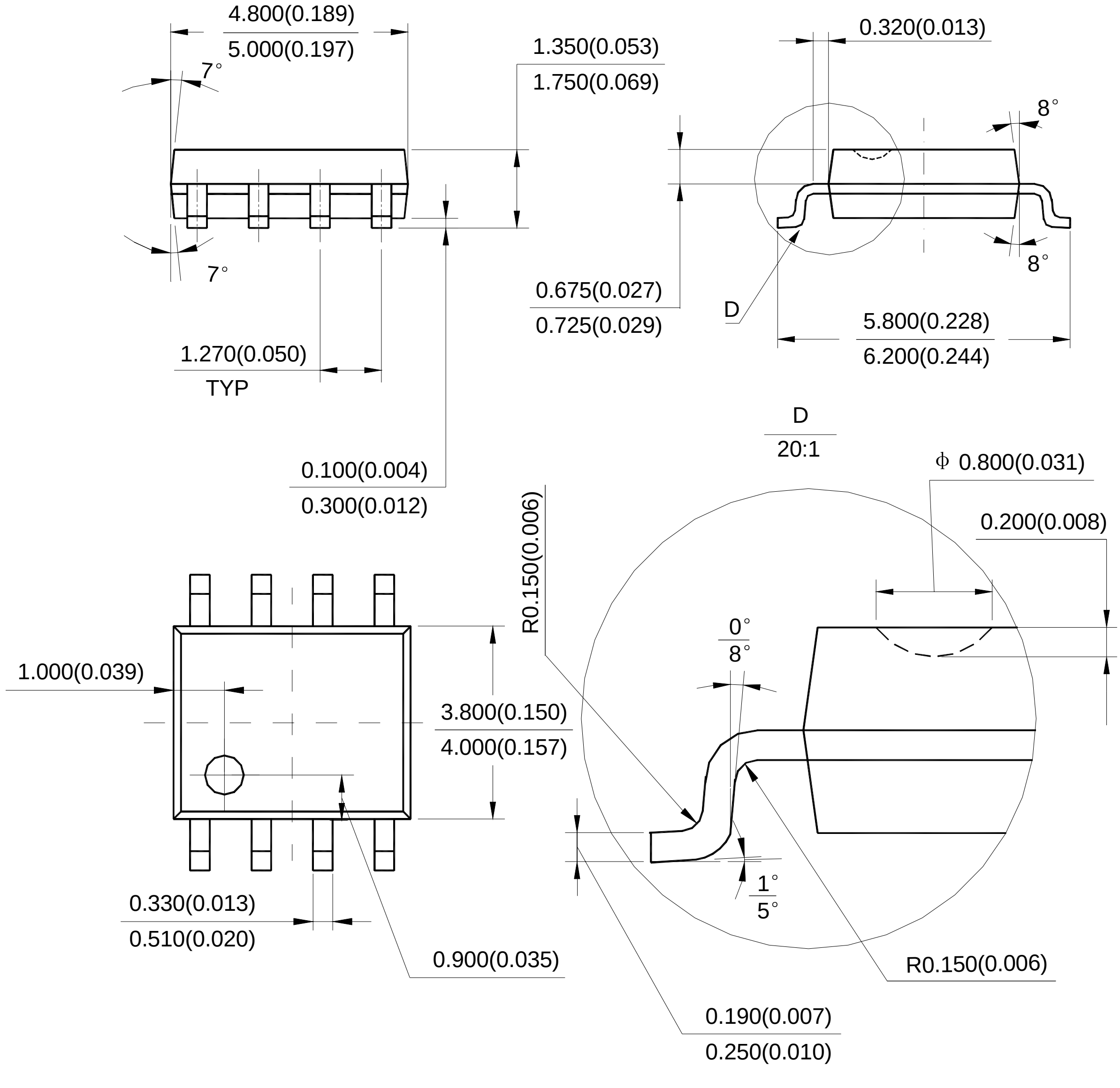
Mechanical Dimensions

DIP-8 **Unit: mm(inch)**



Mechanical Dimensions (Continued)

SOIC-8 **Unit: mm(inch)**



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