

**LOW POWER DUAL OPERATIONAL AMPLIFIERS****AS358/358A****General Description**

The AS358/358A consist of two independent, high gain and internally frequency compensated operational amplifiers, they are 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. Typical applications include transducer amplifiers, DC gain blocks and most conventional operational amplifier circuits.

The AS358/358A series are compatible with industry standard 358. AS358A has more stringent input offset voltage than AS358.

The AS358 is available in DIP-8, SOIC-8, TSSOP-8 and MSOP-8 packages, AS358A is available in DIP-8 and SOIC-8 packages.

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:
 - Single Supply: 3V to 36V
 - Dual Supplies: $\pm 1.5V$ to $\pm 18V$
- Input Common Mode Voltage Range Includes Ground
- Large Output Voltage Swing: 0V to $V_{CC} - 1.5V$

Applications

- Battery Charger
- Cordless Telephone
- Switching Power Supply

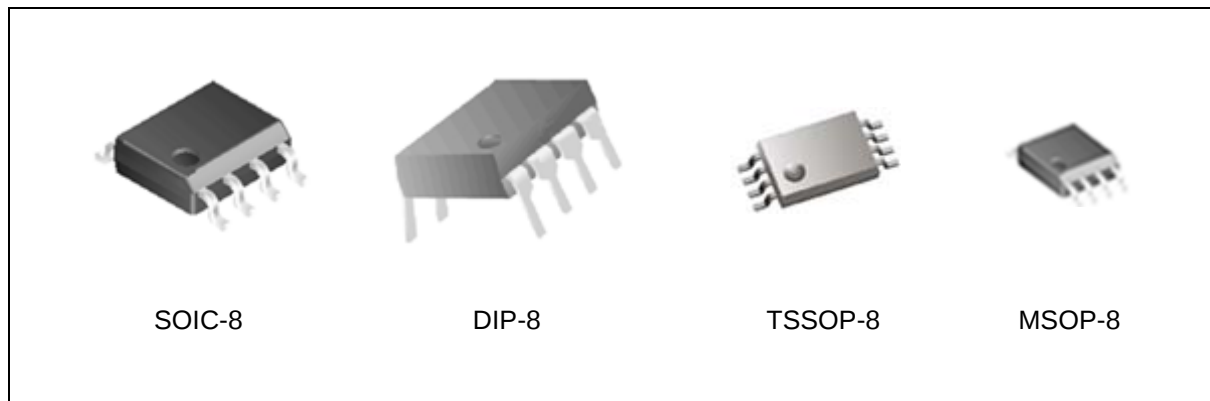


Figure 1. Package Types of AS358/358A



LOW POWER DUAL OPERATIONAL AMPLIFIERS

AS358/358A

Pin Configuration

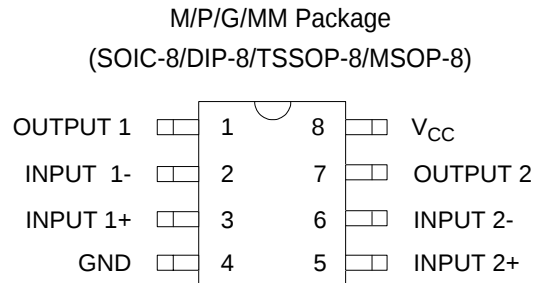


Figure 2. Pin Configuration of AS358/358A (Top View)

Functional Block Diagram

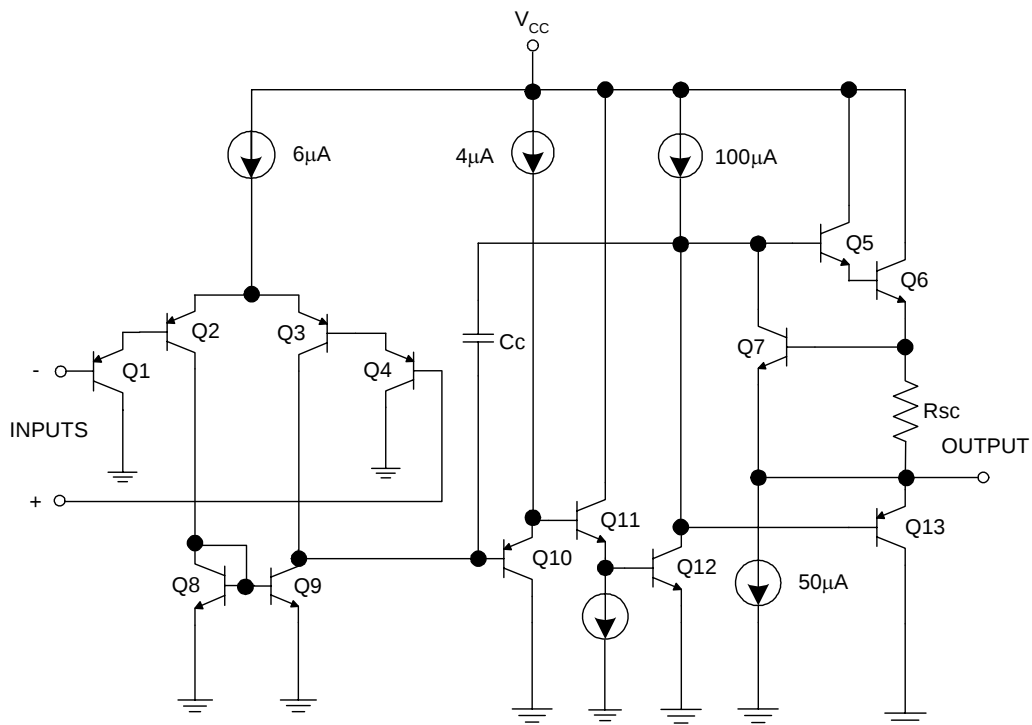


Figure 3. Functional Block Diagram of AS358/358A
(Each Amplifier)



LOW POWER DUAL OPERATIONAL AMPLIFIERS

AS358/358A

Ordering Information

	AS358	□	□	□	-	□	
Circuit Type							E1: Lead Free Blank: Tin Lead TR: Tape and Reel Blank: Tube
Blank: AS358							Package
A: AS358A							M: SOIC-8 P: DIP-8 G: TSSOP-8 MM: MSOP-8

Package	Temperature Range	Part Number		Marking ID		Packing Type
		Tin Lead	Lead Free	Tin Lead	Lead Free	
SOIC-8	-40 to 85°C	AS358M	AS358M-E1	AS358M	AS358M-E1	Tube
		AS358MTR	AS358MTR-E1	AS358M	AS358M-E1	Tape & Reel
			AS358AM-E1		AS358AM-E1	Tube
			AS358AMTR-E1		AS358AM-E1	Tape & Reel
DIP-8	-40 to 85°C	AS358P	AS358P-E1	AS358P	AS358P-E1	Tube
			AS358AP-E1		AS358AP-E1	Tube
TSSOP-8	-40 to 85°C		AS358G-E1		EG3A	Tube
			AS358GTR-E1		EG3A	Tape & Reel
MSOP-8	-40 to 85°C		AS358MM-E1		AS358MM-E1	Tube
			AS358MMTR-E1		AS358MM-E1	Tape & Reel

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

**LOW POWER DUAL OPERATIONAL AMPLIFIERS****AS358/358A****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value		Unit
Power Supply Voltage	V_{CC}	40		V
Differential Input Voltage	V_{ID}	40		V
Input Voltage	V_{IC}	-0.3 to 40		V
Power Dissipation ($T_A=25^{\circ}\text{C}$)	P_D	DIP-8	830	mW
		SOIC-8	550	
		TSSOP-8	500	
		MSOP-8	470	
Operating Junction Temperature	T_J	150		$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}	-65 to 150		$^{\circ}\text{C}$
Lead Temperature (Soldering, 10 Seconds)	T_{LEAD}	260		$^{\circ}\text{C}$

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.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	3	36	V
Ambient Operating Temperature Range	T_A	-40	85	$^{\circ}\text{C}$



LOW POWER DUAL OPERATIONAL AMPLIFIERS

AS358/358A

Electrical Characteristics

Limits in standard typeface are for $T_A=25^{\circ}\text{C}$, **bold** typeface applies over -40°C to 85°C (Note 2), $V_{CC}=5\text{V}$, $\text{GND}=0\text{V}$, 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 30V	AS358		2	5	mV
						7		
			AS358A		2	3		
						5		
Average Temperature Coefficient of Input Offset Voltage		ΔV _{IO} /ΔT	T _A =-40 to 85°C			7		μV/°C
Input Bias Current		I _{BIAS}	I _{IN} ⁺ or I _{IN} ⁻ , V _{CM} =0V			20	200	nA
							200	
Input Offset Current		I _{IO}	I _{IN} ⁺ - I _{IN} ⁻ , V _{CM} =0V			5	30	nA
							100	
Input Common Mode Voltage Range (Note 3)		V _{IR}	V _{CC} =30V		0		V _{CC} -1.5	V
Supply Current		I _{CC}	T _A =-40 to 85°C, R _L =∞, V _{CC} =30V			0.7	2	mA
			T _A =-40 to 85°C, R _L =∞, V _{CC} =5V			0.5	1.2	
Large Signal Voltage Gain		G _V	V _{CC} =15V, V _O =1V to 11V, R _L ≥ 2kΩ		85	100		dB
					80			
Common Mode Rejection Ratio		CMRR	DC, V _{CM} =0V to (V _{CC} -1.5)V		60	70		dB
					60			
Power Supply Rejection Ratio		PSRR	V _{CC} =5V to 30V		70	100		dB
					60			
Channel Separation		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
					20			
		Sink	I _{SINK}	V _{IN} ⁺ =0V, V _{IN} ⁻ =1V, V _{CC} =15V, V _O =2V	10	15		mA
					5			
				V _{IN} ⁺ =0V,V _{IN} ⁻ =1V,V _{CC} =15V, V _O =0.2V	12	50		μA
Output Short Circuit Current to Ground		I _{SC}	V _{CC} =15V			40	60	mA
Output Voltage Swing		V _{OH}	V _{CC} =30V, R _L =2kΩ		26			V
					26			
			V _{CC} =30V, R _L =10kΩ		27	28		
					27			
		V _{OL}	V _{CC} =5V, R _L = 10kΩ			5	20	mV
							30	

Note 2: Limits over the full temperature are guaranteed by design, but not tested in production.



LOW POWER DUAL OPERATIONAL AMPLIFIERS

AS358/358A

Electrical Characteristics (Continued)

Note 3: 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 +36V without damages, independent of the magnitude of the V_{CC} .

Typical Performance Characteristics

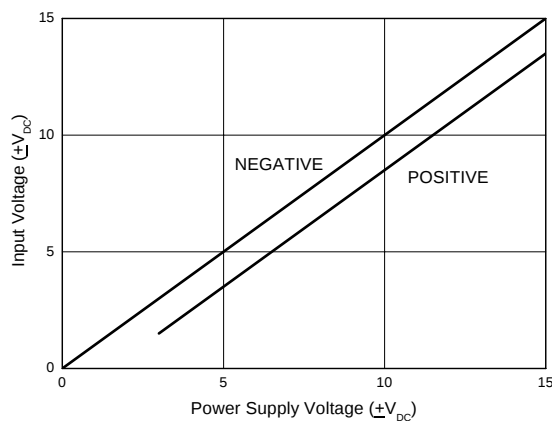


Figure 4. Input Voltage Range

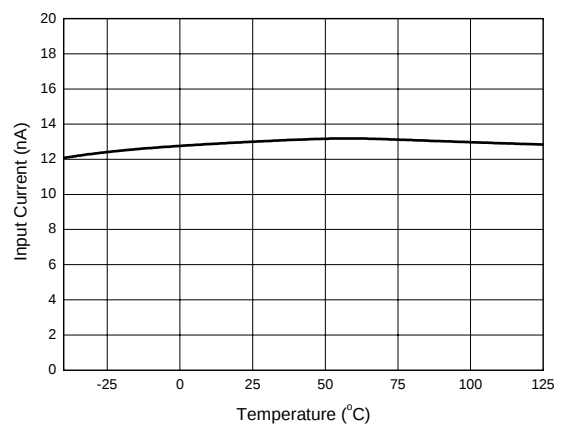


Figure 5. Input Current

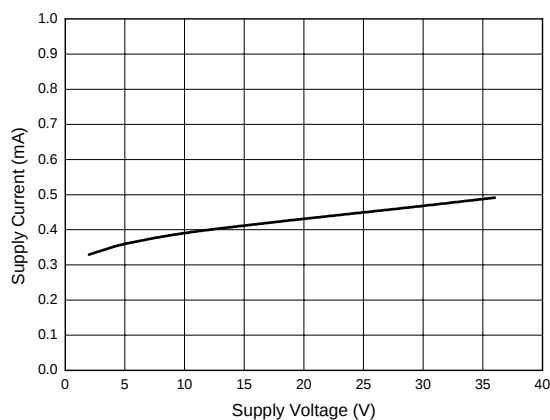


Figure 6. Supply Current

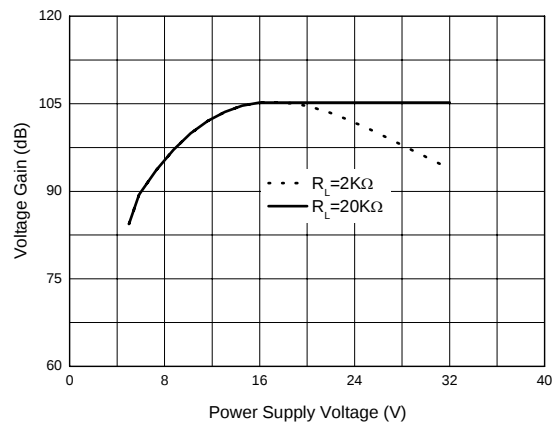


Figure 7. Voltage Gain



LOW POWER DUAL OPERATIONAL AMPLIFIERS

AS358/358A

Typical Performance Characteristics (Continued)

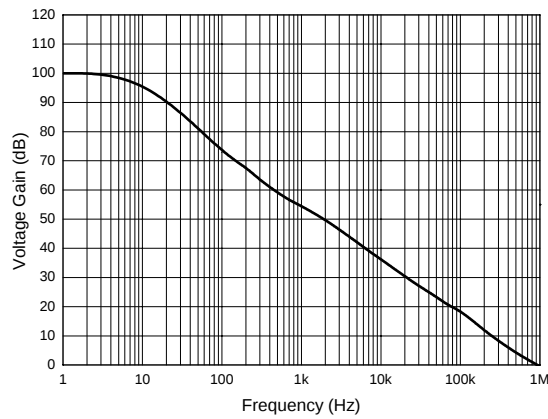


Figure 8. Open Loop Frequency Response

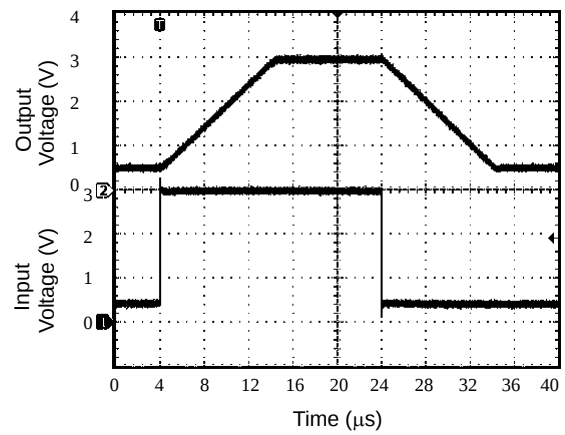


Figure 9. Voltage Follower Pulse Response

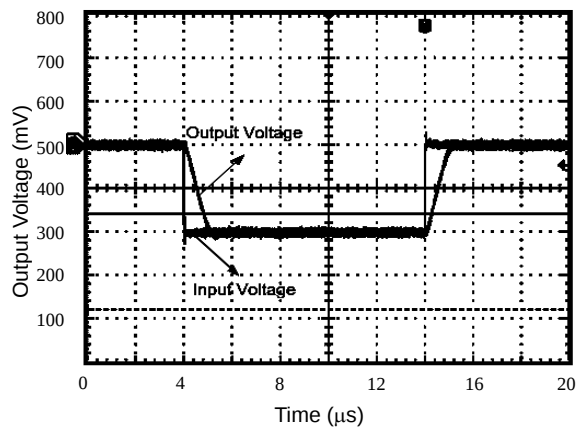


Figure 10. Voltage Follower Pulse Response
(Small Signal)

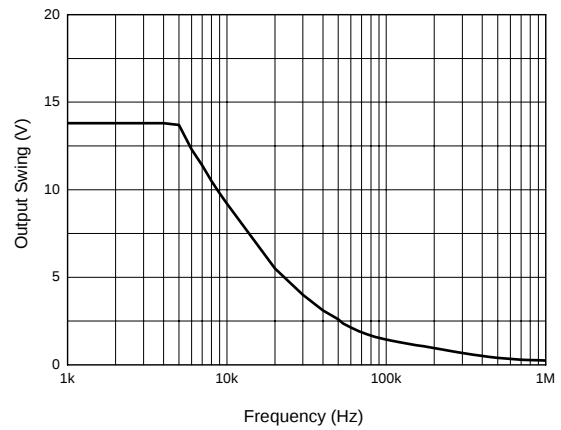


Figure 11. Large Signal Frequency Response

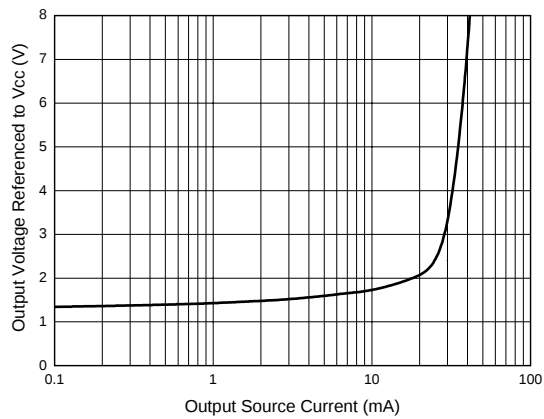
**LOW POWER DUAL OPERATIONAL AMPLIFIERS****AS358/358A****Typical Performance Characteristics (Continued)**

Figure 12. Output Characteristics: Current Sourcing

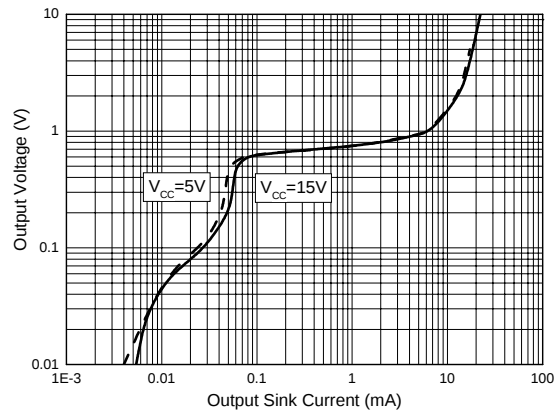


Figure 13. Output Characteristics: Current Sinking

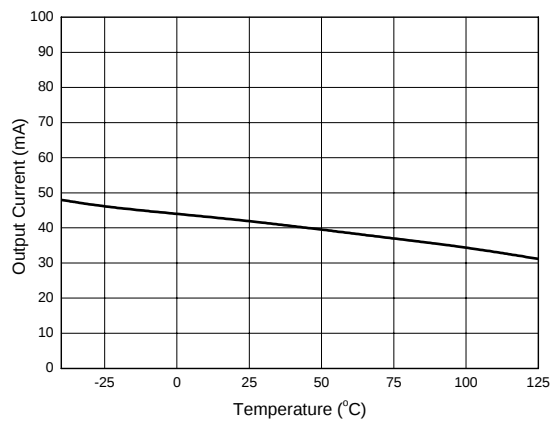


Figure 14. Current Limiting



LOW POWER DUAL OPERATIONAL AMPLIFIERS

AS358/358A

Typical Application

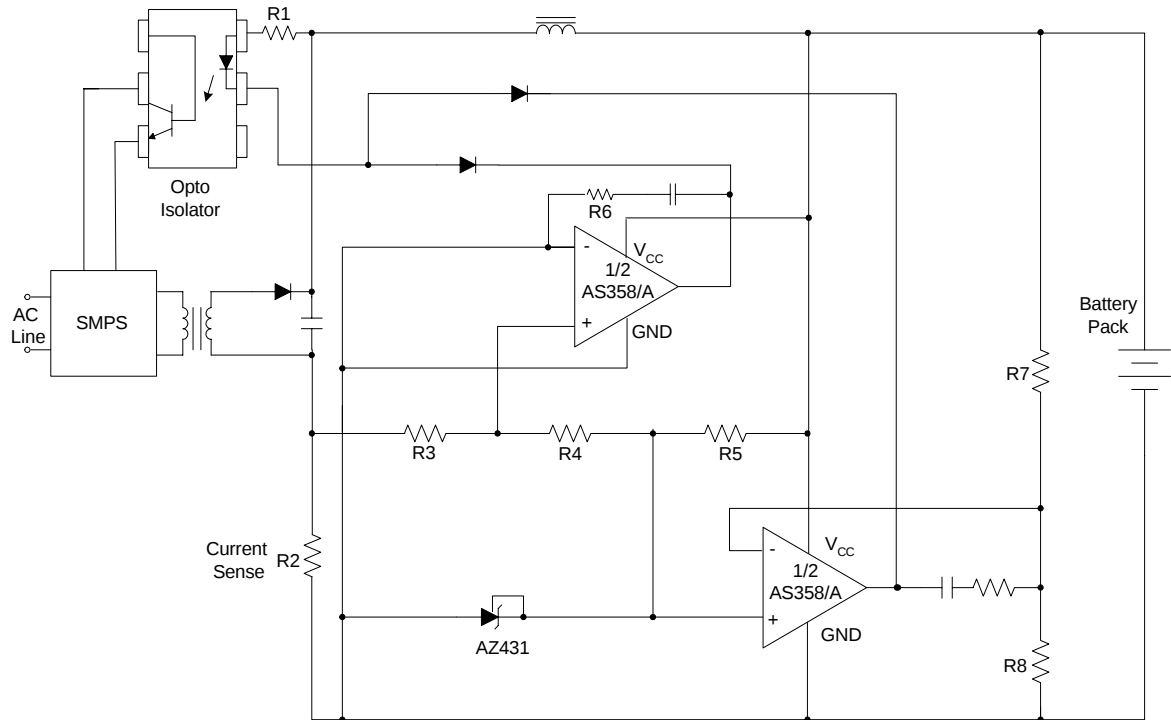


Figure 15. Battery Charger

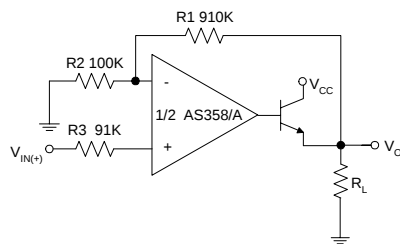


Figure 16. Power Amplifier

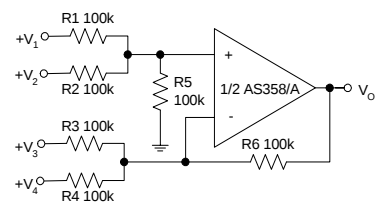


Figure 17. DC Summing Amplifier



LOW POWER DUAL OPERATIONAL AMPLIFIERS

AS358/358A

Typical Application (Continued)

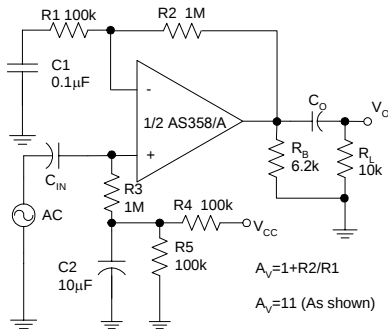


Figure 18. AC Coupled Non-Inverting Amplifier

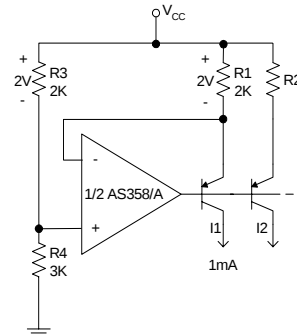


Figure 19. Fixed Current Sources

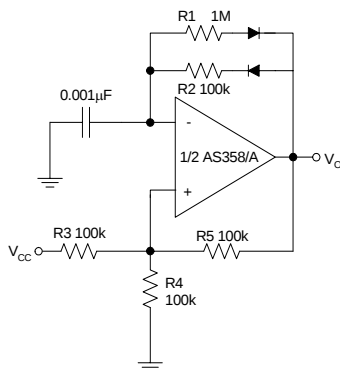


Figure 20. Pulse Generator

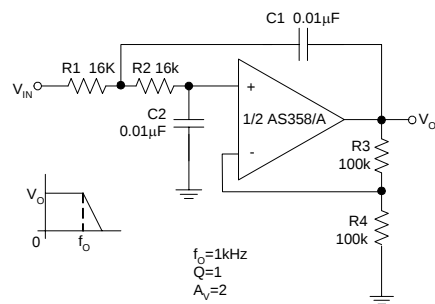
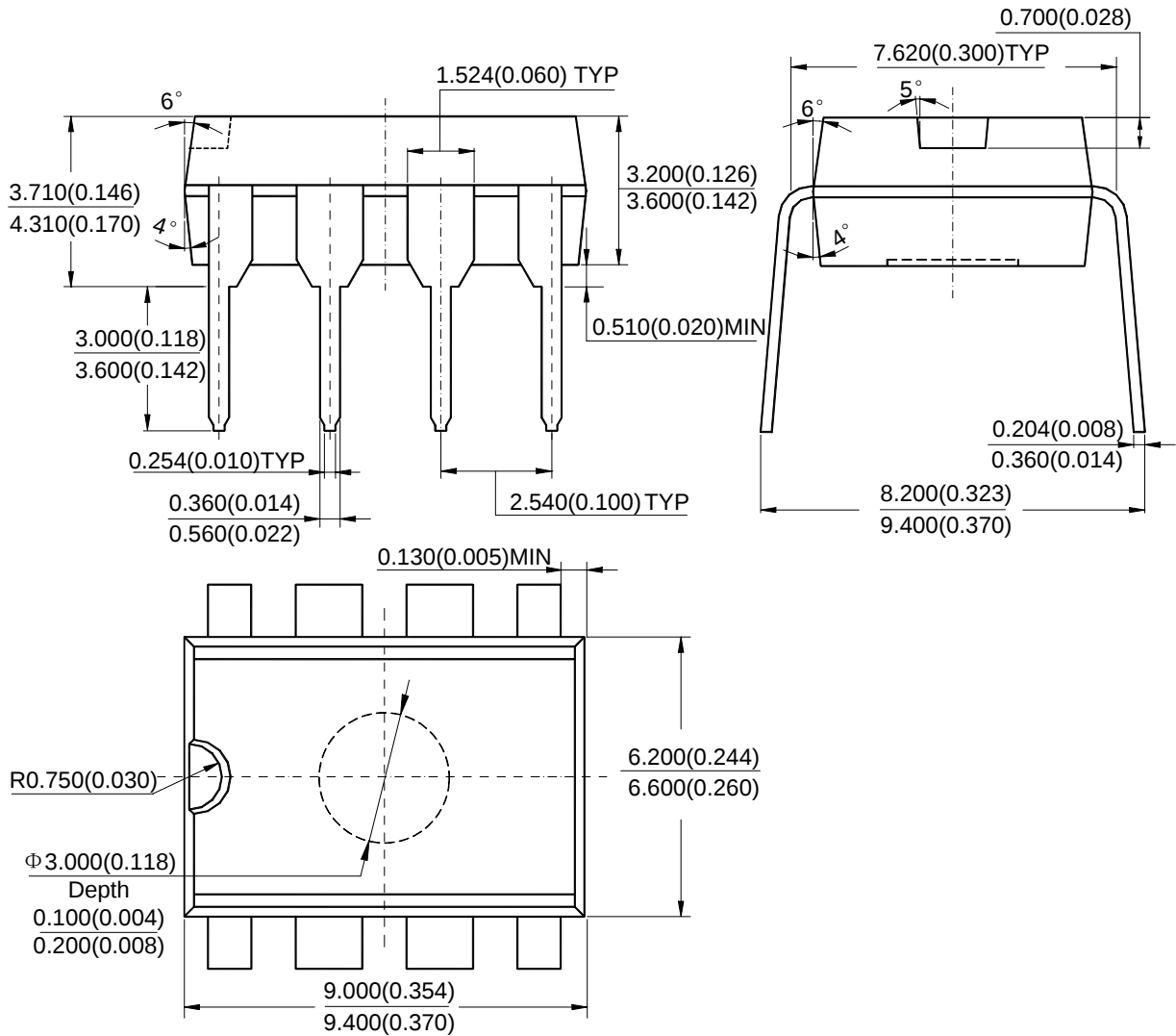
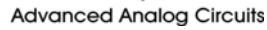


Figure 21. DC Coupled Low-Pass Active Filter

**LOW POWER DUAL OPERATIONAL AMPLIFIERS****AS358/358A****Mechanical Dimensions****DIP-8****Unit: mm(inch)**

**SOIC-8**[illegible]



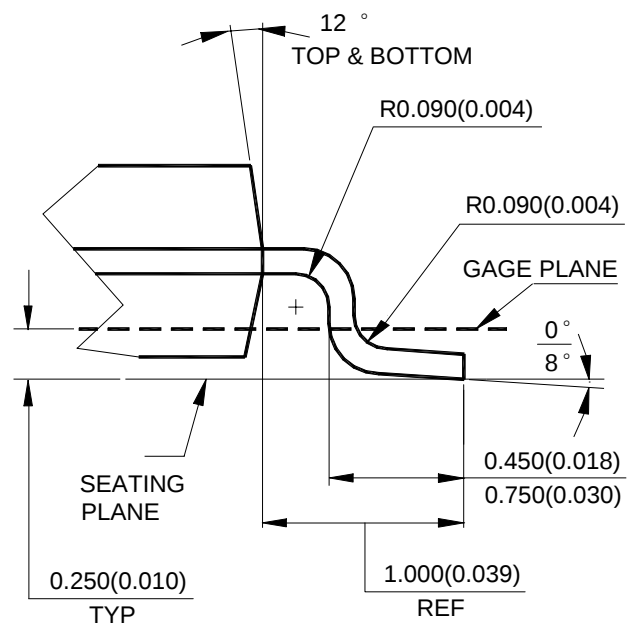
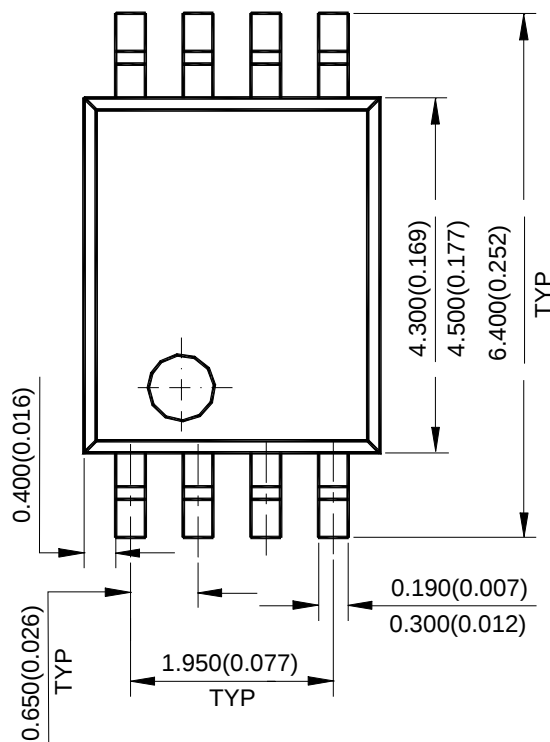
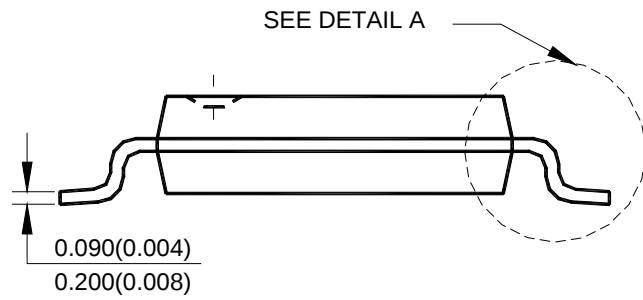
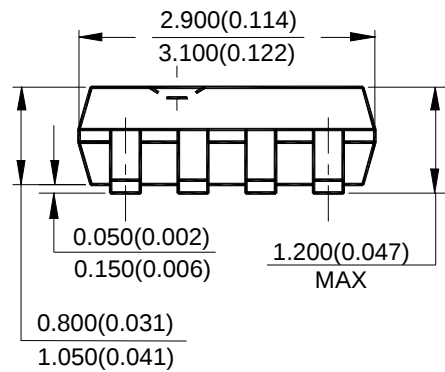
LOW POWER DUAL OPERATIONAL AMPLIFIERS

AS358/358A

Mechanical Dimensions (Continued)

TSSOP-8

Unit: mm(inch)



DETAIL A



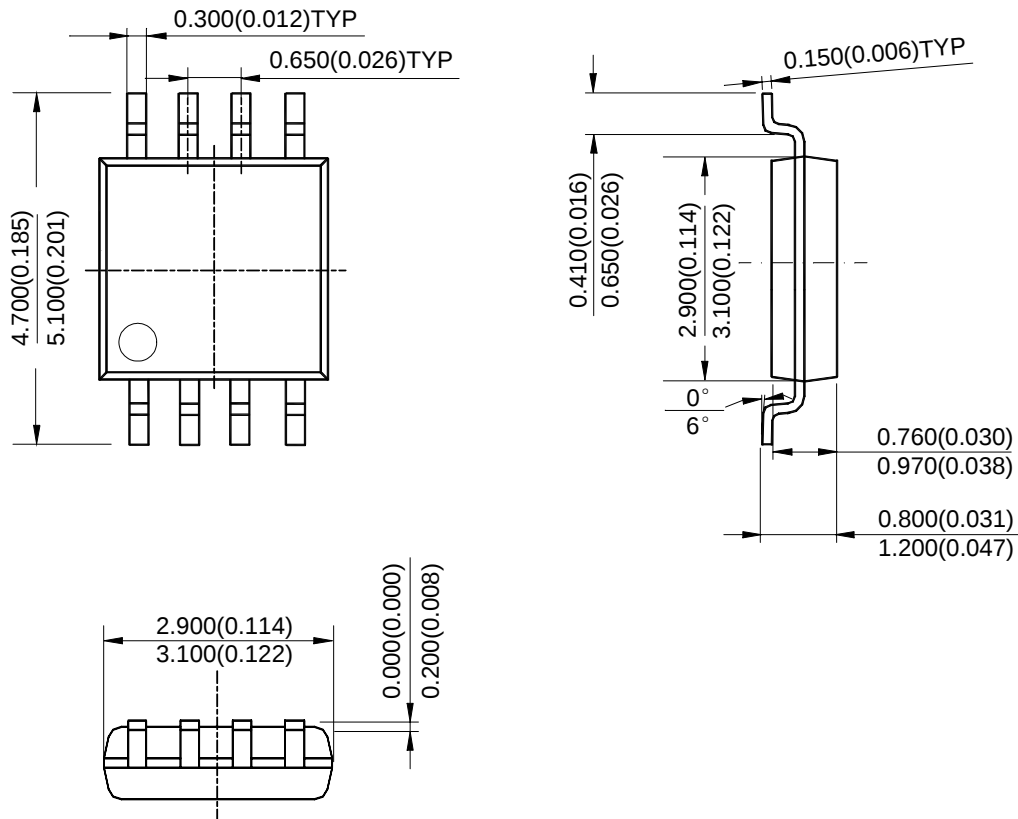
LOW POWER DUAL OPERATIONAL AMPLIFIERS

AS358/358A

Mechanical Dimensions

MSOP-8

Unit: mm(inch)





BCD Semiconductor Manufacturing Limited

<http://www.bcdsemi.com>

IMPORTANT NOTICE

BCD Semiconductor Manufacturing Limited reserves the right to make changes without further notice to any products or specifications herein. BCD Semiconductor Manufacturing Limited does not assume any responsibility for use of any its products for any particular purpose, nor does BCD Semiconductor Manufacturing Limited assume any liability arising out of the application or use of any its products or circuits. BCD Semiconductor Manufacturing Limited does not convey any license under its patent rights or other rights nor the rights of others.

MAIN SITE

BCD Semiconductor Manufacturing Limited

- Wafer Fab

Shanghai SIM-BCD Semiconductor Manufacturing Limited

800, Yi Shan Road, Shanghai 200233, China
Tel: +86-21-6485 1491, Fax: +86-21-5450 0008

BCD Semiconductor Manufacturing Limited

- IC Design Group

Advanced Analog Circuits (Shanghai) Corporation

8F, Zone B, 900, Yi Shan Road, Shanghai 200233, China
Tel: +86-21-6495 9539, Fax: +86-21-6485 9673

REGIONAL SALES OFFICE

Shenzhen Office

Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd. Shenzhen Office

Advanced Analog Circuits (Shanghai) Corporation Shenzhen Office

Room E, 5F, Noble Center, No.1006, 3rd Fuzhong Road, Futian District, Shenzhen 518026, China
Tel: +86-755-8826 7951, Fax: +86-755-8826 7865

Taiwan Office

BCD Semiconductor (Taiwan) Company Limited

4F, 298-1, Rui Guang Road, Nei-Hu District, Taipei, Taiwan
Tel: +886-2-2656 2808, Fax: +886-2-2656 2806

USA Office

BCD Semiconductor Corporation

3170 De La Cruz Blvd., Suite 105,
Santa Clara,
CA 95054-2411, U.S.A