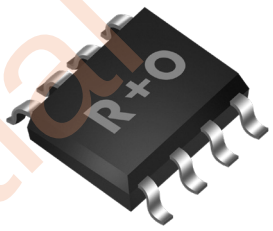
Low-Power Dual Operational Amplifiers

Features

- Bandwidth: 1.0MHz
- Large DC Voltage Gain: 100 dB
- Input Voltage Range: -0.3V to +36V or ±1.5V to ±18V
- Low input bias current: 500μA
- Differential input voltage range equal to the power supply voltage
- Operating temperature range: -40°C to +125°C
- Input common-mode voltage range includes negative rails
- Input Offset Voltage: 2.0mV(Typ.)
- Large output voltage swing 0 V to (V_{CC}^+ - 1.5 V)

Supply Voltage
+3.0V ~ +36V
Offset Voltage
2.0mV

SOP-8



Applications

- Power Module
- Sensor Interface
- Motor Control
- Audio
- Battery Charger
- Cordless Telephone

General Description

These circuits consist of two independent, high-gain, internally frequency-compensated op amps, specifically designed to operate from a single power supply or dual power supplys over a wide range of voltages. The low-power supply drain is independent of the magnitude of the power supply voltage.

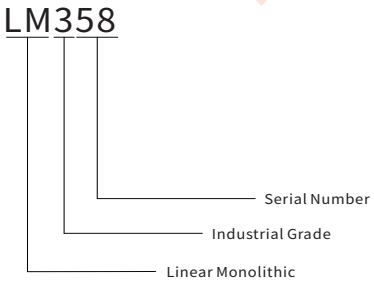
Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits.

In linear mode, the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from only a single power supply voltage.

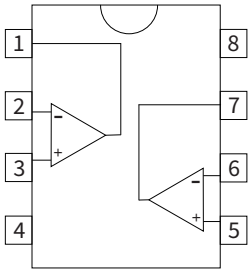
Reference News

SOP-8 Marking:
LM358: R+O+LM358+Date code

Part Numbering



Pin Configuration



Pin Description

Pin Number	Pin Name	Description
1	OUT1	Output, channel 1
2	IN-	Inverting input, channel 1
3	IN+	Noninverting input, channel 1
4	V-	V_{CC}-
5	IN2+	Inverting input, channel 2
6	IN2-	Noninverting input, channel 2
7	OUT2	Output, channel 2
8	V+	V_{CC}+

Ordering Information

Order Number	Package	Package Code	Unit Weight(g)	Reel(pcs)	Box(pcs)	Carton(pcs)	Delivery Mode
LM358	SOP-8	R3	0.077	4000	8000	80000	13"

Functional Block Diagram

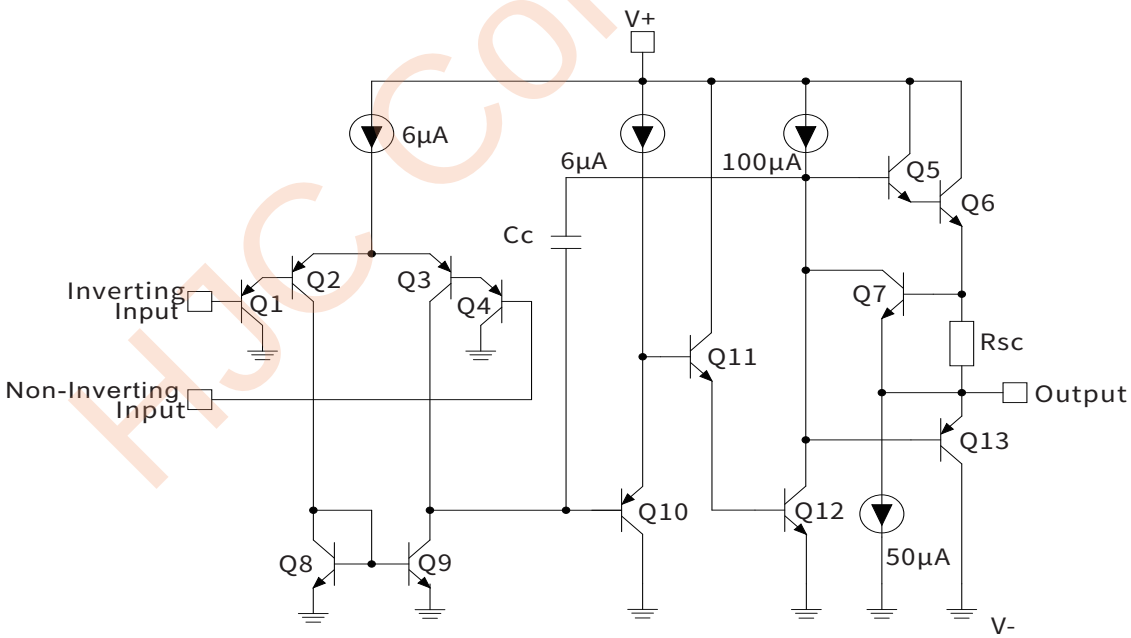


Figure 1.Internal Block Diagram

Absolute Maximum Ratings (T_A=25°C Unless otherwise specified.)

Parameter	Symbol	Value	Unit
Supply Voltage, $(+V_S)-(-V_S)$	V_{CC}	36V or ± 18V	V
Differential input voltage	V_{Id}	36	V
Input voltage	V_i	-0.3 to 36	V
Maximum Junction Temperature	T_J	150	°C
Common Mode Input Voltage Range(T_A = 25°C)	V_{ICR}	0 to (V_{CC}+) - 1.5	V
Output short-circuit to GND Note1	I_{SC}	Infinite	mA
Input current(V_{IN}< -0.3V) Note2	I_i	50	mA
Thermal resistance junction to ambient Note3	R_{thja}	125	°C /W
Thermal resistance junction to case Note3	R_{thjc}	40	
Operating Temperature Range	T_{OPR}	–40 to 125°C	°C
Storage Temperature Range	T_{STG}	–65 to 150°C	°C

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.Electrostatic discharge can also cause damage to chips, so it is suggested to take some preventive measures for integrated circuits. Failure to follow proper handling and installation can also cause damage. Precision LM358 and other devices are more vulnerable to damage than ordinary devices in the case of tiny electrostatic, and small parameter changes may make the whole circuit performance substandard.

Note1. Short-circuits from the output to V_{CC} can cause excessive heating if V_{CC} > 15 V. The maximum output current is approximately 40mA independent of the magnitude of V_{CC}. Destructive dissipation can result from simultaneous short circuits on all amplifiers.

Note2. This input current only exists when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistor becoming forward-biased and thereby acting as input diode clamp. In addition to this diode action, there is NPN parasitic 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 during which an input is driven negative. This is not destructive and normal output is restored for input voltages above -0.3 V.

Note3. Short-circuits can cause excessive heating and destructive dissipation. R_{th} are typical values.

Electrical Characteristics (V_{CC}+ = 5V, V_{CC}- = Ground, T_A=25℃ ,unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
AC Specifications						
Gain-Bandwidth Product	GBW	C_L=100pF	--	1.0	--	MHz
Slew Rate	SR	A_V= 20dB, V_{OUT}= $2V_{P-P}$,C_{LOAD}= 100pF R_{LOAD}= 2kΩ, f = 1kHz	--	0.4	--	V/μs
DC Characteristics						
Input Offset Voltage	V_{OS}	T_A = 25°C	--	1	3	mV
		-40°C ⩽ T_A ⩽ +125°C	--	--	7	mV
Input Bias Current	I_B	T_A = 25°C	--	25	250	nA
		-40°C ⩽ T_A ⩽ +125°C	--	50	500	nA
Input Offset Current	I_{OS}	T_A = 25°C	--	5	50	nA
		-40°C ⩽ T_A ⩽ +125°C	--	--	150	nA
Power Supply Rejection Ratio	PSRR	V_{CC}+ = 5.0V to 30V	75	100	--	dB
Large Signal Voltage Gain	A_{vd}	V_{CC}+ = 15V, R_L ⩾ 2kΩ, Vo = 1V to 11V	50	100	--	dB
		-40°C ⩽ Ta ⩽ +125°C	25	--	--	dB
Quiescent Current	I_Q	-40°C ⩽ T_A ⩽ +125°C , V_{CC}+ = 30V, R_L = ∞	--	1.0	3.0	mA
		-40°C ⩽ T_A ⩽ +125°C , V_{CC}+ = 5.0V, R_L = ∞	--	0.5	1.2	mA
Short-Circuit Current	I_{SC}	V_{CC}+ = 15V	--	40	60	mA
V_{o1}/V_{o2}	Channel separation	1 kHz ⩽ f ⩽ 20 kHz	--	-120	--	dB
Input Characteristics						
Common-mode Input Voltage Range	V_{CMR}	V_{CC}+ = 30V, T_A = 25°C	0	--	V_{CC}+ - 1.5	V
		-40°C ⩽ T_A ⩽ +125°C	0	--	V_{CC}+ - 2	V
Common Mode Rejection Ratio	CMRR	V_{CM}=0 to V_{CC}+ - 1.5V	70	90	--	dB
Output Characteristics						
Output Current	I_{source}	V_{IN}(+) = 1V, V_{IN}(-) = 0V, V_{CC}+ = 15V, V_o = 2V	20	40	--	mA
	I_{sink}	V_{IN}(-) = 1V, V_{IN}(+) = 0V, V_{CC}+ = 15V, V_o = 2V	10	20	--	mA
		V_{IN}(-) = 1V, V_{IN}(+) = 0V, V_{CC}+ = 15V, V_o = 200mV	12	50	--	μA
Output Voltage Swing	V_{OH}	V_{CC}+ = 30V, R_L = 2kΩ	26	--	--	V
		V_{CC}+ = 30V, R_L = 10kΩ	27	28	--	V
	V_{OL}	V_{CC}+ = 5V, R_L=100kΩ	--	5	20	mV

Typical Applications(Single Supply Voltage V_{CC}+ = 5.0V, V_{CC}- = 0V)

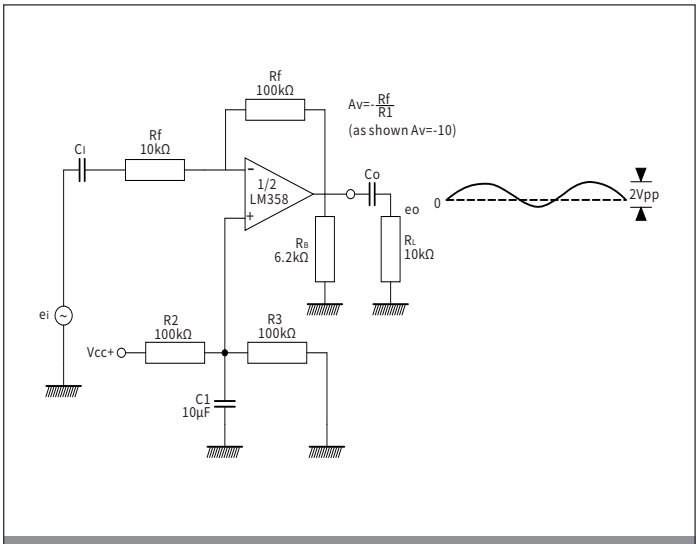


Fig.2 AC-Coupled Inverting Amplifier

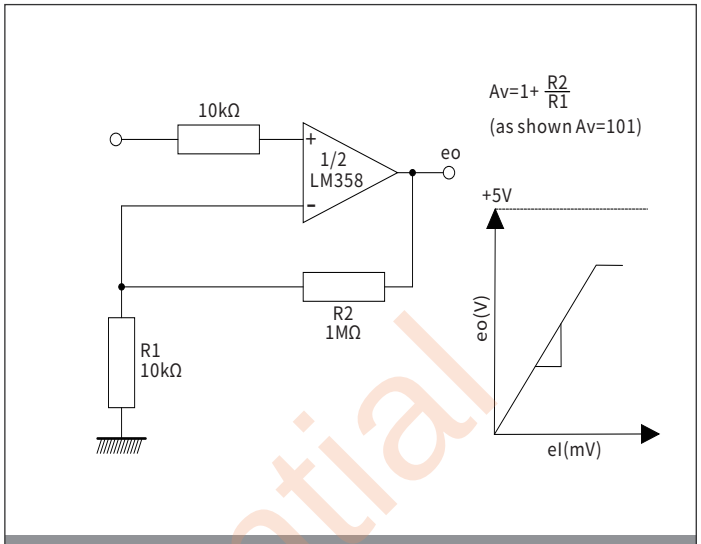


Fig.3 Non-Inverting DC Amplifier

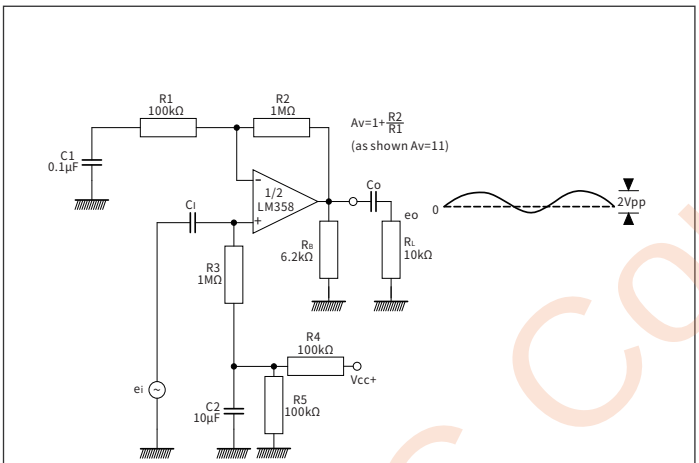


Fig.4 AC-Coupled Non-Inverting Amplifier

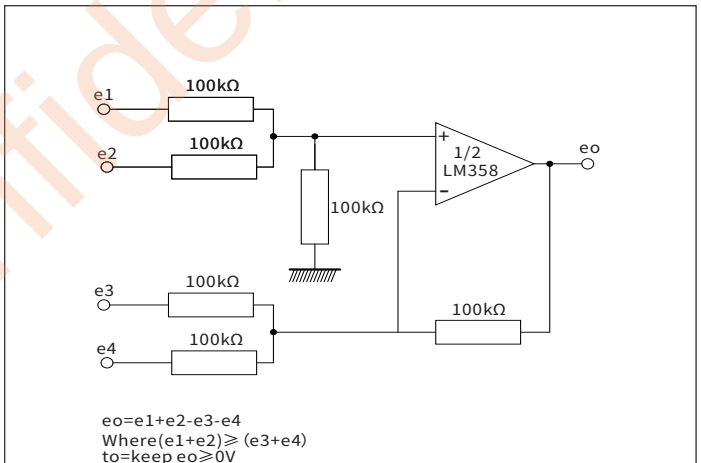


Fig.5 DC Summing Amplifier

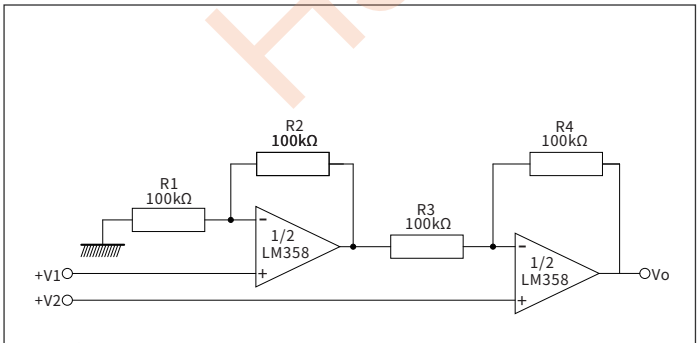


Fig.6 High input Z, DC Differential Amplifier

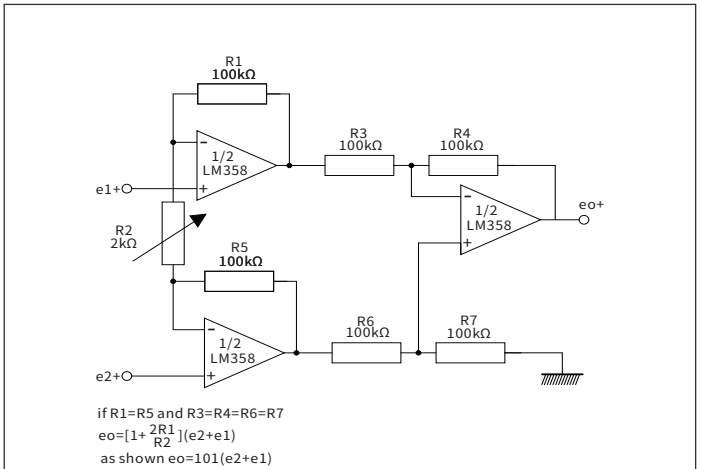


Fig.7 High Input Z Adjustable Gain DC Instrumentation Amplifier

Typical Applications(Cont.)

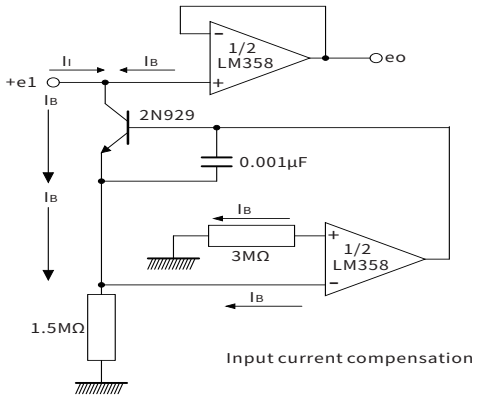


Fig.8 Using Symmetrical Amplifiers to Reduce Input Current

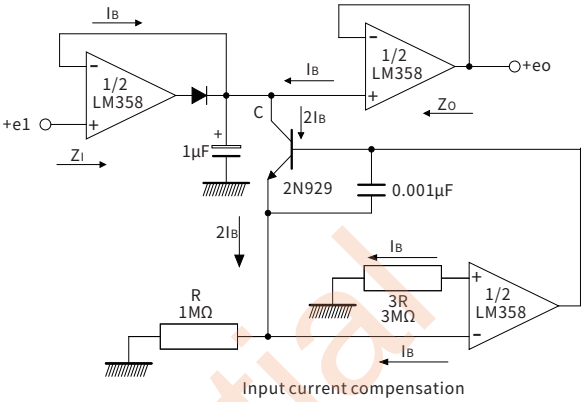


Fig.9 Low Drift Peak Detector

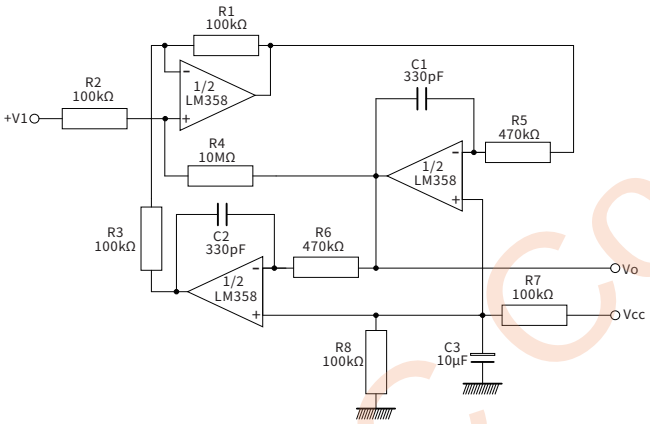
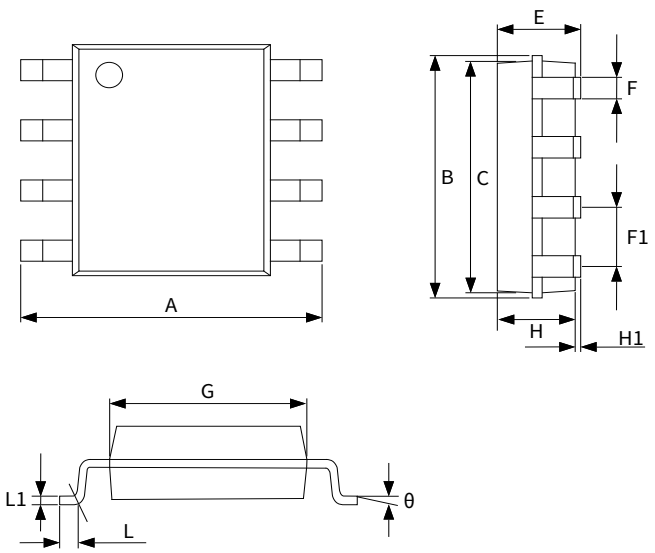


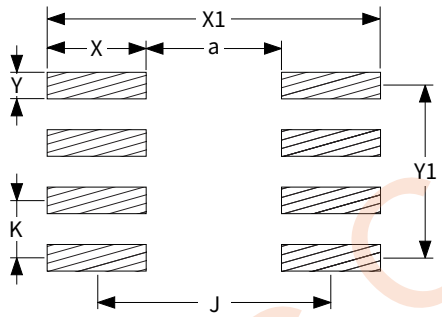
Fig.10 Active Band-Pass Filter

Package Outline Dimensions (SOP-8)



Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	5.70	6.30	0.224	0.248
B	5.13MAX.		0.202MAX.	
C	4.72	5.12	0.186	0.201
E	1.80MAX.		0.071MAX.	
F	0.31	0.51	0.0122	0.020
F1	1.27TYP.		0.050TYP.	
G	3.75	4.15	0.148	0.163
H	1.35	1.65	0.053	0.065
H1	0.1	0.25	0.004	0.010
L	0.3	0.7	0.012	0.028
L1	0.21TYP.		0.008TYP.	
θ	-	8°	-	8°

Suggested Pad Layout



Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
a	2.90	3.10	0.114	0.122
J	5.10	5.30	0.201	0.209
K	1.17	1.37	0.046	0.054
X	2.10	2.30	0.083	0.091
X1	7.30	7.50	0.287	0.295
Y	0.50	0.70	0.020	0.028
Y1	3.71	3.91	0.146	0.154