

# MSKSEMI 美森科

SEMICONDUCTOR



ESD



TVS



TSS



MOV



GDT



PLED

## LM358

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产品手册

## 产品简介

LM358 是一款双路低功耗的差分式运算放大器，可以单电源或双电源供电。具有较高的开环增益、内部补偿、高共模范围和良好的温度稳定性，以及具有输出短路保护的特点。广泛应用于传感器的放大电路、直流放大模块、音频放大电路和传统的运算放大电路中。


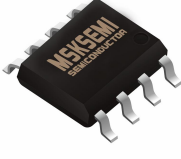
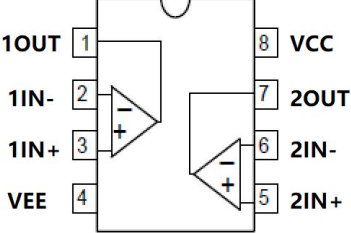
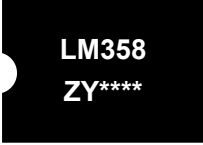
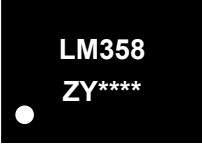
## 产品特点

- 内部频率补偿
- 短路保护
- 低功耗：典型值 0.5mA @ $V_{cc}=5V$
- 封装形式：DIP-8、SOP-8
- 单电源电压范围：3V~36V
- 双电源电压范围：±18V
- 单位增益带宽：可达 1.2MHz

## 产品用途

- 传感器信号放大器
- 直流增益
- 音频放大器
- 其它应用领域

## 封装形式和管脚功能定义

封装形式		管脚定义	丝印	
		 <p>1 1OUT 2 1IN- 3 1IN+ 4 VEE 5 2IN+ 6 2IN- 7 2OUT 8 VCC</p>		
DIP-8	SOP-8		DIP-8	SOP-8

Notes :\*\*\*\*Represent production order code

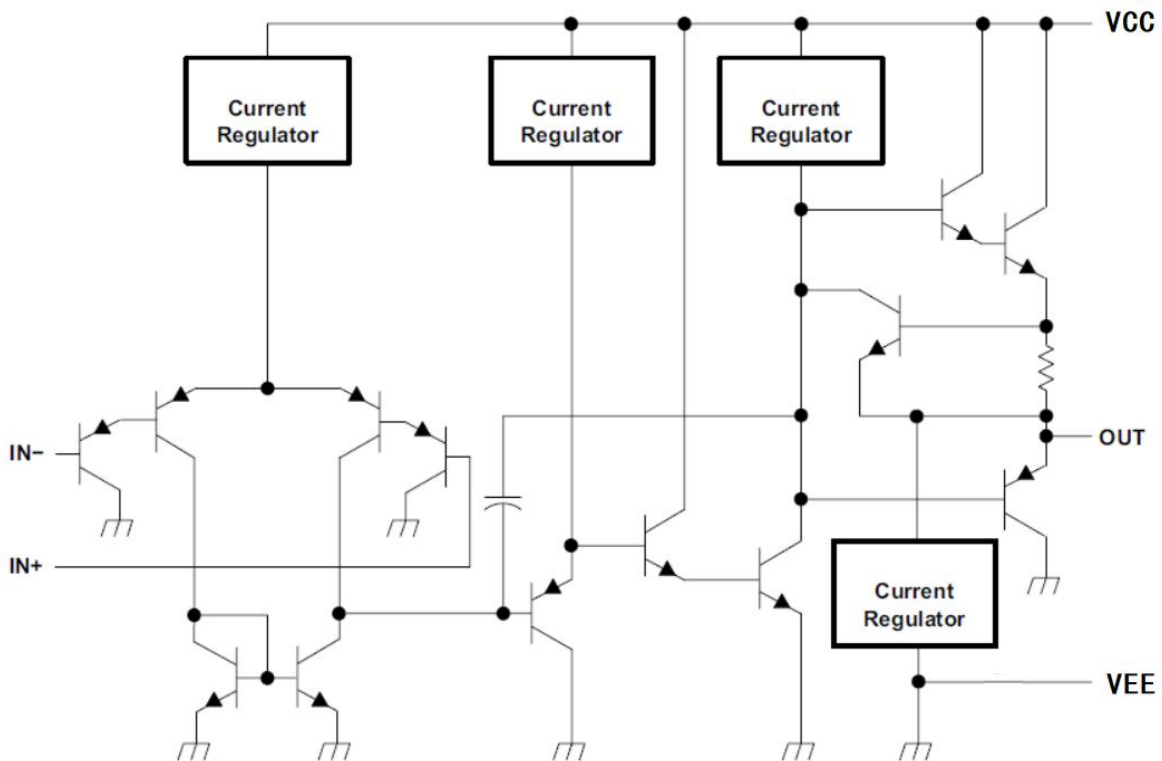
DIP-8/SOP-8 管脚序号	管脚定义	功能说明
1	1OUT	第 1 路运放输出
2	1IN-	第 1 路运放反相输入
3	1IN+	第 1 路运放正相输入
4	VEE	负电源
5	2IN+	第 2 路运放正相输入
6	2IN-	第 2 路运放反相输入
7	2OUT	第 2 路运放输出
8	VCC	正电源

**极限参数**

项目	符号	极限值 <sup>(1)</sup>	单位
单电源供电电压	$V_{CC}$	40	V
双电源供电电压	$V_S$	$\pm 20$	V
差分输入电压 <sup>(2)</sup>	$V_{ID}$	$\pm 40$	V
共模输入电压	$V_{ICR}$	-0.3~40V	V
输出短路时间	$t_{sc}$	连续	
耗散功率	$P_D$	400	mW
工作温度	$T_A$	0-70	$^{\circ}C$
储存温度	$T_S$	-65-150	$^{\circ}C$
焊接温度	$T_W$	260, 10s	$^{\circ}C$

**注：**（1）极限值是指无论在任何条件下都不能超过的极限值。如果达到此极限值，将有可能造成产品劣化等物理性损伤；同时在接近极限参数下，不能保证芯片可以正常工作。  
 （2）输入端  $IN+$  相对于  $IN-$  之间的电压差。

**等效原理图**

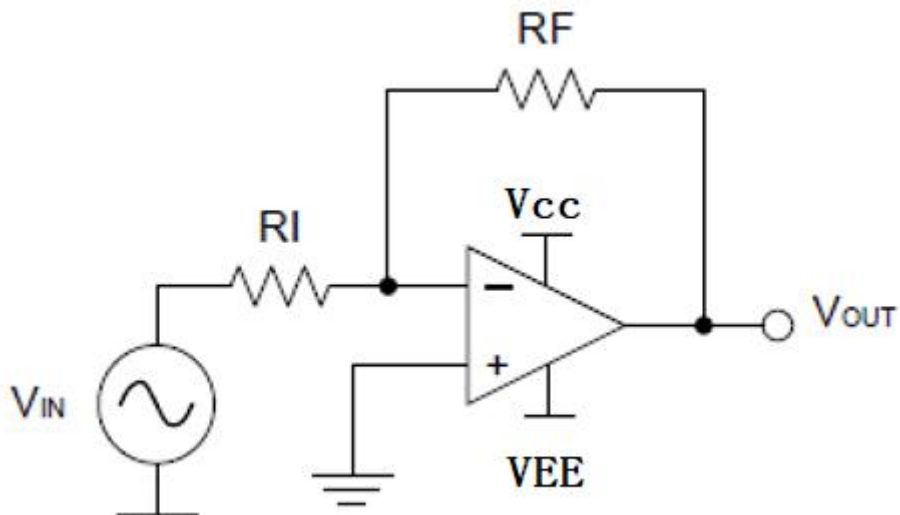


直流电学特性 (T<sub>A</sub>=25°C, VCC=5V, VEE=GND 除非特别指定)

项目	符号	测试条件	最小值	典型值	最大值	单位	
输入失调电压	V <sub>IO</sub>	VCC=5V to MAX, V <sub>IC</sub> =V <sub>ICR</sub> (min), V <sub>O</sub> =1.4V	-	5	-	mV	
输入失调电流	I <sub>IO</sub>	V <sub>O</sub> = 1.4 V	-	10	50	nA	
偏置电流	I <sub>BIAS</sub>	V <sub>O</sub> = 1.4 V	-	50	250	nA	
共模输入电压	V <sub>ICR</sub>	VCC=5V to 36V	VEE	-	VCC-1.5V	V	
开环电压增益	AOL	VCC=15V, V <sub>O</sub> =1V to 11V, R <sub>L</sub> ≥2kΩ	-	100	-	V/mV	
共模抑制比	CMRR	VCC=5V to MAX, V <sub>IC</sub> =V <sub>ICR</sub> (min)	-	80	-	dB	
单位增益带宽	GBWP		-	1.2	-	MHZ	
电源电压抑制比P <sub>SSR</sub>	ΔV <sub>VDD</sub> /ΔV <sub>IO</sub>	VCC=5V to MAX, f=20kHz	-	90	-	dB	
串扰衰减抑制比CS	V <sub>O1</sub> /V <sub>O2</sub>	f=1kHz to 20kHz	-	120	-	dB	
输出高电平电压	V <sub>OH</sub>	VCC=15V, V <sub>ID</sub> =1V	I <sub>out</sub> = -50uA	-	13.6	-	V
			I <sub>out</sub> = -1mA	-	13.5	-	V
			I <sub>out</sub> = -5mA	-	13.4	-	V
		VCC=28V	R <sub>L</sub> =2k	-	26	-	V
输出低电平电压	V <sub>OL</sub>	VCC=15V, V <sub>ID</sub> =-1V	I <sub>out</sub> = 50uA	-	0.1	-	V
			I <sub>out</sub> = 1mA	-	0.7	-	V
			I <sub>out</sub> = 5mA	-	1.0	-	V
		VCC=28V	R <sub>L</sub> =2k	-	0.85	-	V
输出短路电流	I <sub>OS</sub>	VCC=5V, VEE=-5V, V <sub>O</sub> =0V	-	±24	-	mA	
电源工作电流	I <sub>CC</sub>	VCC=5V, V <sub>O</sub> =1/2VCC, No load	-	0.5	-	mA	
		VCC=36, V <sub>O</sub> =1/2VCC, No load	-	0.8	-	mA	
单电源工作电压	VCC	VEE=0V (GND)	3	-	36	V	
双电源工作电压	V <sub>S</sub>	VCC, VEE	-18	-	+18	V	

典型应用

1、线路图



## 2、设计要求

必须选择大于输入电压范围和输出范围的电源电压。

例如，将信号源 VIN 从 ±0.5 V 放大到 ±1.8V。将电源设置为 ±5 V 足以适应此应用要求。

## 3、设计过程

根据公式(1)计算放大倍数(增益)  $A_V$

$$A_V = -V_O/V_{IN} \quad \text{-----(1)}$$

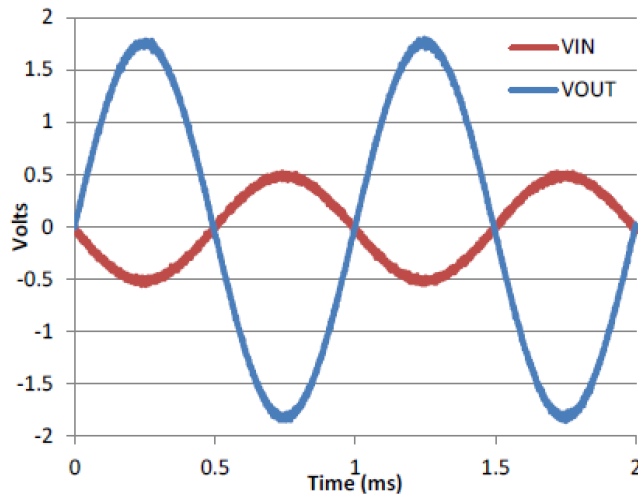
$$A_V = -V_O/V_{IN} = -1.8/0.5 = -3.6$$

一旦确定了所需的增益  $A_V$ ，就要为  $R_I$  或  $R_F$  电阻选择一个值。根据运放的电特性及功耗的需要，可选择  $1k\Omega$  -  $100k\Omega$  范围内的值。本例将选择  $R_I = 10k\Omega$ ，则  $R_F = 36k\Omega$ 。这由方程式 2 确定。

$$A_V = -R_F/R_I \quad \text{-----(2)}$$

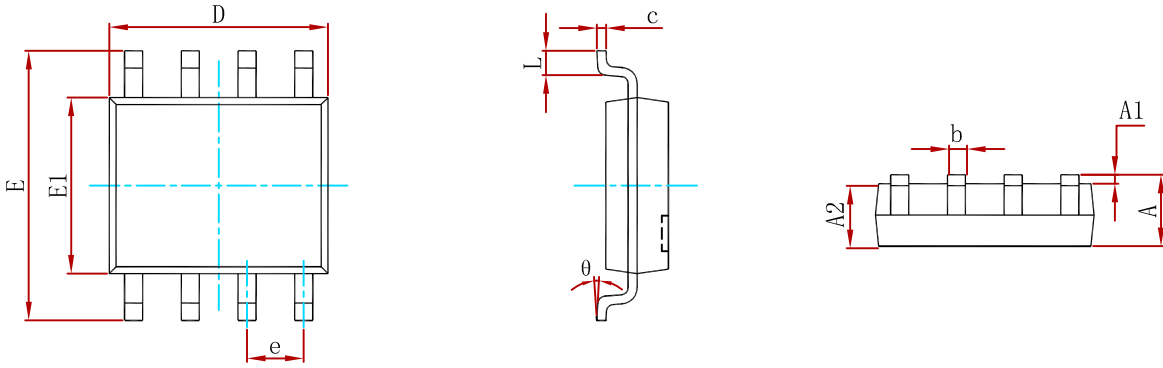
$$R_F = -A_V * R_I = 3.6 * 10 = 36k\Omega$$

## 4、应用曲线图



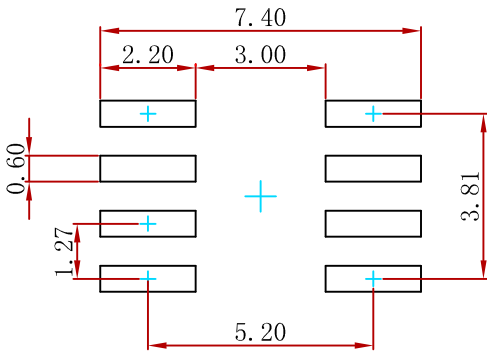
反相放大器的输入电压 VS 输出电压

**封装信息**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
e	1.270 (BSC)		0.050 (BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

**焊盘尺寸建议**

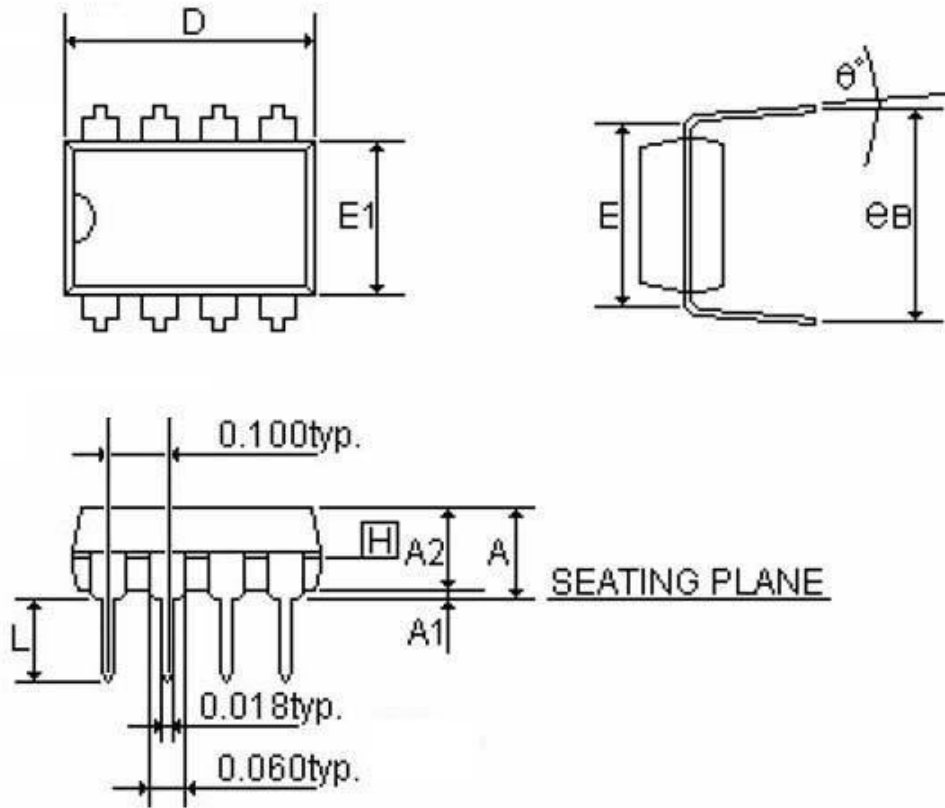


Note:  
 1. Controlling dimension: in millimeters.  
 2. General tolerance:  $\pm 0.05\text{mm}$ .  
 3. The pad layout is for reference purposes only.

**订购信息**

P/N	PKG	QTY
LM358	SOP-8	2500

DIP 8



SYMBOLS	MIN	NOR	MAX	MIN	NOR	MAX
	(inch)			(mm)		
A	-	-	0.210	-	-	5.334
A1	0.015	-	-	0.381	-	-
A2	0.125	0.130	0.135	3.175	3.302	3.429
D	0.435	0.455	0.475	15.669	16.050	16.685
E	0.300			7.62		
E1	0.245	0.250	0.255	6.223	6.35	6.477
L	0.115	0.130	0.150	2.921	3.302	3.810
e B	0.335	0.355	0.375	8.509	9.017	9.525
θ°	0°	7°	15°	0°	7°	15°

订购信息

P/N	PKG	QTY
LM358	DIP-8	50

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