LM358 Dual Operational Amplifiers

1. General Description

1.1 Description

The LM358 includes two high-voltage (30V) op amps. These devices provide outstanding value for cost-sensitive applications, with features including low offset, common-mode input range to ground, and high differential input voltage capability.

The LM358 op amps simplify circuit design with enhanced features such as unity-gain stability, lower offset voltage and lower quiescent current . Integrated EMI and RF filters enable the LM358 to be used in the most rugged, environmentally challenging applications.

1.2 Features

- Wide range of single supply voltage 3V to 30V
- Unity-gain bandwidth of 4MHz(Typ) at 25℃
- 1mV(Typ) input offset voltage at 25°C
- Low input bias current: maximum 250nA
- Common-mode input voltage range includes ground, enabling direct sensing near ground

1.3 Device Information

PART NUMBER	PACKAGE
LM358	DIP
	SOP
	TSSOP
	DFN

2. Connection Diagrams and Pin Description

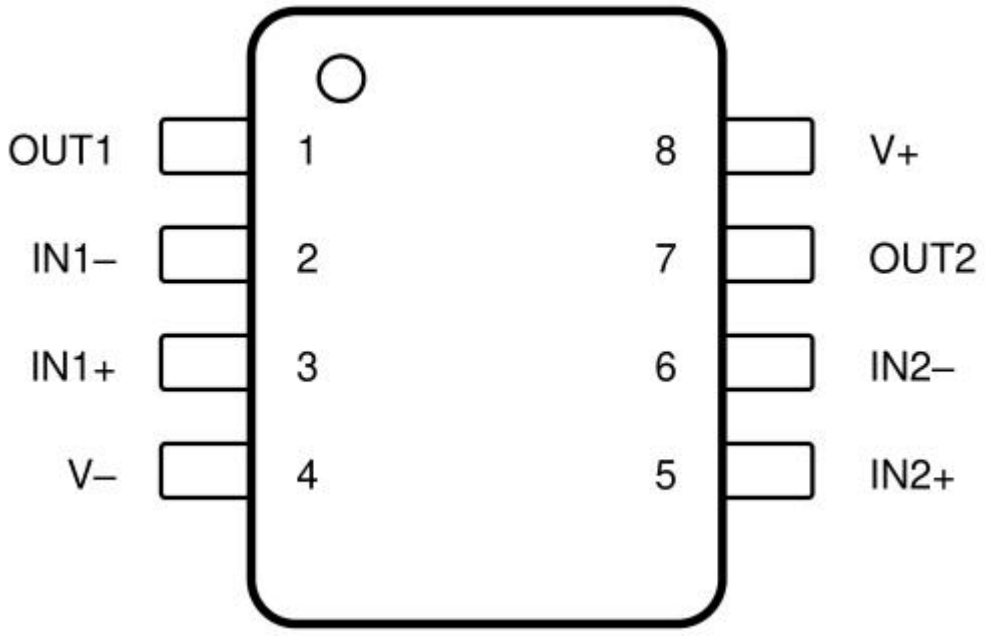


Figure 2.1: Top View

PIN No.	NAME	I/O	FUNCTION
1	1OUT	O	Output
2	1IN-	I	Negative Input
3	1IN+	I	Positive Input
4	V-	-	Negative (lowest) supply or ground (for single-supply operation)
5	2IN+	I	Positive Input
6	2IN-	I	Negative Input
7	2OUT	O	Output
8	V+	-	Positive (highest) supply

3. Schematic Diagram

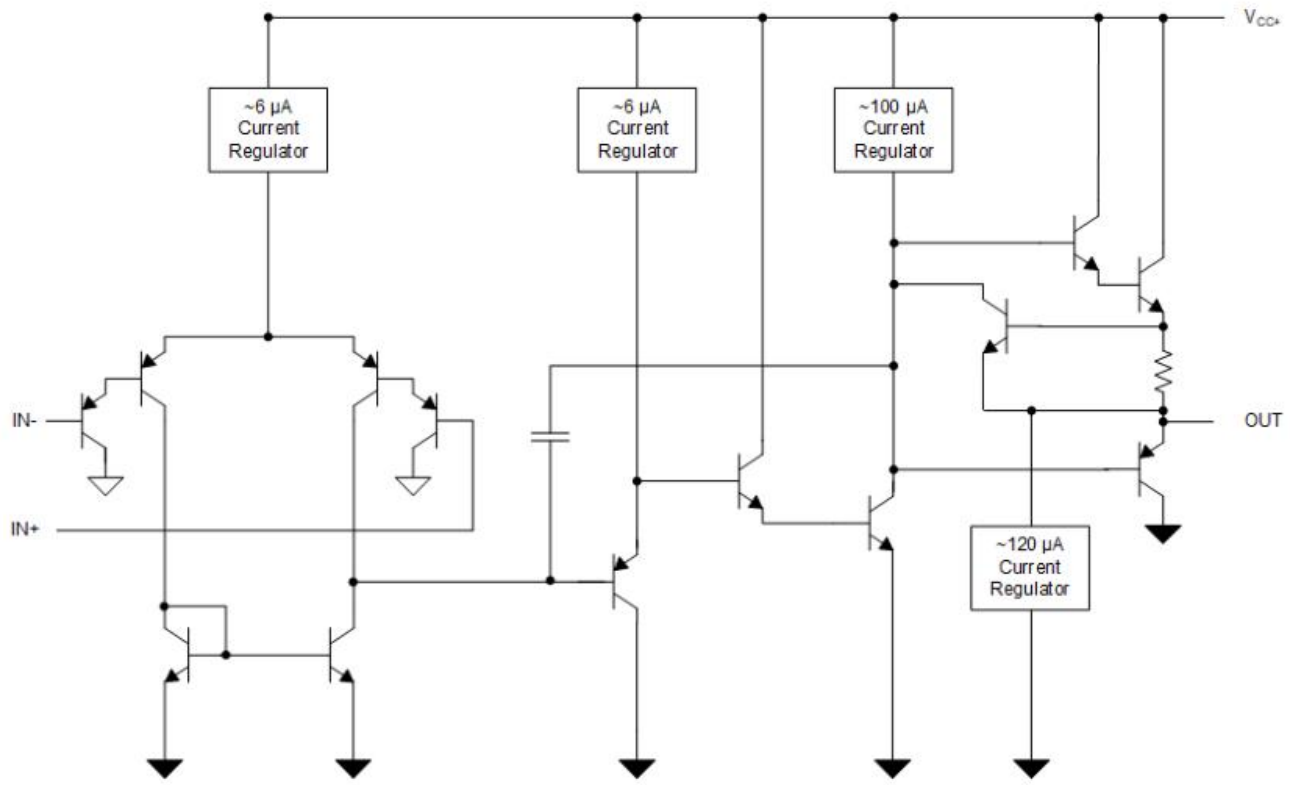


Figure 3.1：LM358 Functional Block Diagram

4. Specifications

4.1 Absolute Maximum Ratings

(Ta=25℃,unless otherwise specified)

Symbol	Parameter	MIN	MAX	Unit
V_S	Supply voltage, $V_S=(V_+ - V_-)$		±18 or 36	V
V_{ID}	Differential Input Voltage(1)	-36	36	V
V_I	Input Voltage(either input)	-0.3	36	V
I_O	Duration of Output Short Circuit to Ground(2)	Unlimited		
T_J	Junction Temperature		150	℃
T_{OP}	Operating Temperature	-40	85	℃

Absolute maximum ratings are those values beyond which the device could be permanently damaged,These are stress ratings only,which do not imply functional operation of the device at these or any other conditions beyond those indicated under normal operating conditions.

(1)Differential voltages are at IN+ with respect to IN-.

(2)Short circuits from outputs to V_S can cause excessive heating and eventual destruction.

4.2 Recommended Operating Conditions

(T_a=25℃,unless otherwise specified)

Symbol	Parameter	MIN	TYP	MAX	Unit
V_S	Supply Voltage, V_S=(V_+ - V_-)	3		30	V
V_{CM}	Common-Mode Voltage	V-		V+ - 2	V

4.3 Electrical Characteristics

For VS = (V+) – (V–) = 5 V, TA = 25°C (unless otherwise noted)

Symbol	Parameter	Test Condition		MIN	TYP	MAX	Unit
I_S	Quiescent current per amplifier	V_O=2.5V,no load		--	0.4	0.8	mA
		V_S=30V,V_O=15V,no load		--	1	1.2	mA
I_B	Input Bias Current	V_O=1.4V		--	-30	-250	nA
V_{IO}	Input Offset Voltage	V_S=5V to 30V V_O=1.4V,Vcm=0		--	1	6	mV
I_{IO}	Input Offset Current	V_O=1.4V		--	2	50	nA
V_{CM}	Common-Mode Voltage Range			V-	-	V+ -1.5	V
A_{OL}	Open-loop voltage gain	V_S=15V, V_O=1V to 11V,R_L≥2kΩ		--	100	--	V/mV
V_{OH}	Output voltage-high	V_S = 30 V; RL = 2 kΩ		26	--	--	V
		V_S = 30 V; RL ≥ 10 kΩ		27	28	--	
		V_S = 5 V; RL ≥ 2 kΩ		3.3	--	--	
V_{OL}	Output voltage-low	V_S = 5 V; RL ≤ 10 kΩ		--	--	20	mV
I_O	Output current	Source	V_S = 15 V; VO = 0 V; VID= 1 V	-20	--	--	mA
		Sink	V_S = 15 V; VO = 15V; VID= -1 V	8	--	--	
GBW	Gain bandwidth product	V_S=30V		--	4	--	MHZ
CMRR	Common-Mode Rejection Ratio	V_{cc}= 5 V to 30 V; V_{CM} = 0 V		--	80	--	dB
PSRR	Supply-Voltage Rejection Ratio(ΔV_{IO} /ΔV_{CC})	V_S= 5 V to 30 V		--	100	--	dB
V_{O1}/ V_{O2}	Channel separation	f=1 kHz to 20 kHz		--	120	--	dB
Isc	Short-circuit current	V_S = 10 V; VO = V_S / 2		--	40	--	mA

All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified.

5. Applications information

A typical application for an operational amplifier in an inverting amplifier. This amplifier takes a positive voltage on the input, and makes it a negative voltage of the same magnitude. In the same manner, it also makes negative voltages positive.

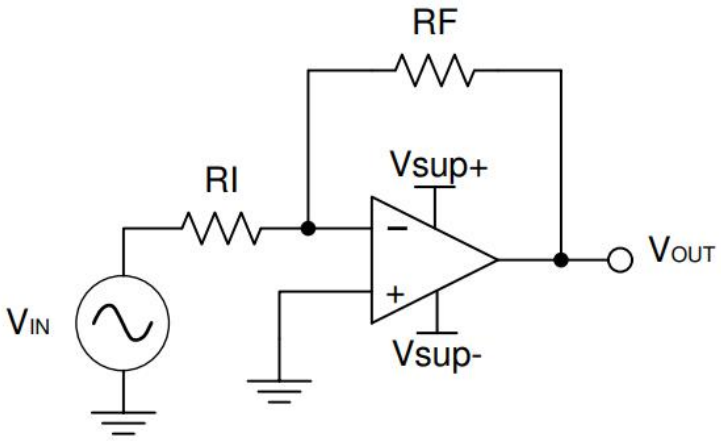


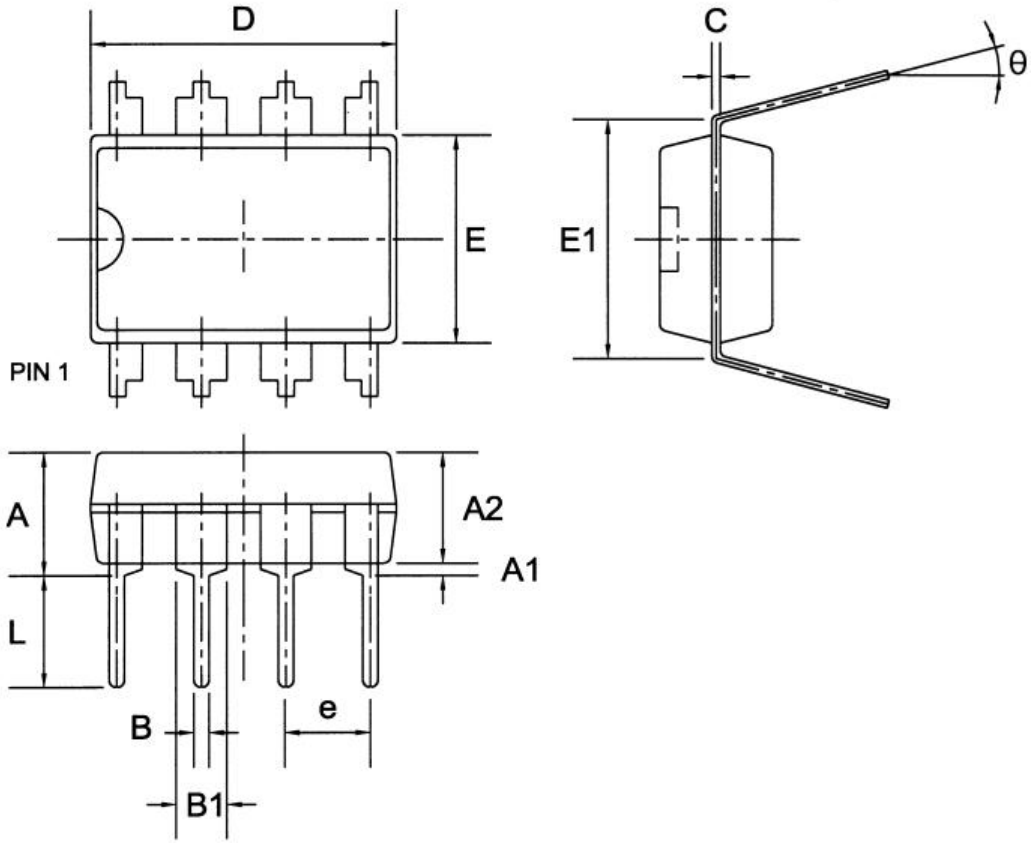
Figure 5.1 Application Schematic

6. Ordering Information

Orderable Device	Package Type	Pins	Packing	Package Qty
LM358ND08ABTEQ	DIP	8	Tube	50
LM358NS08ABRBE	SOP	8	Tape & Reel	2500
LM358TS08ABRBQ	TSSOP	8	Tape & Reel	2000
LM358AD08ABRDQ	DFN	8	Tape & Reel	4000

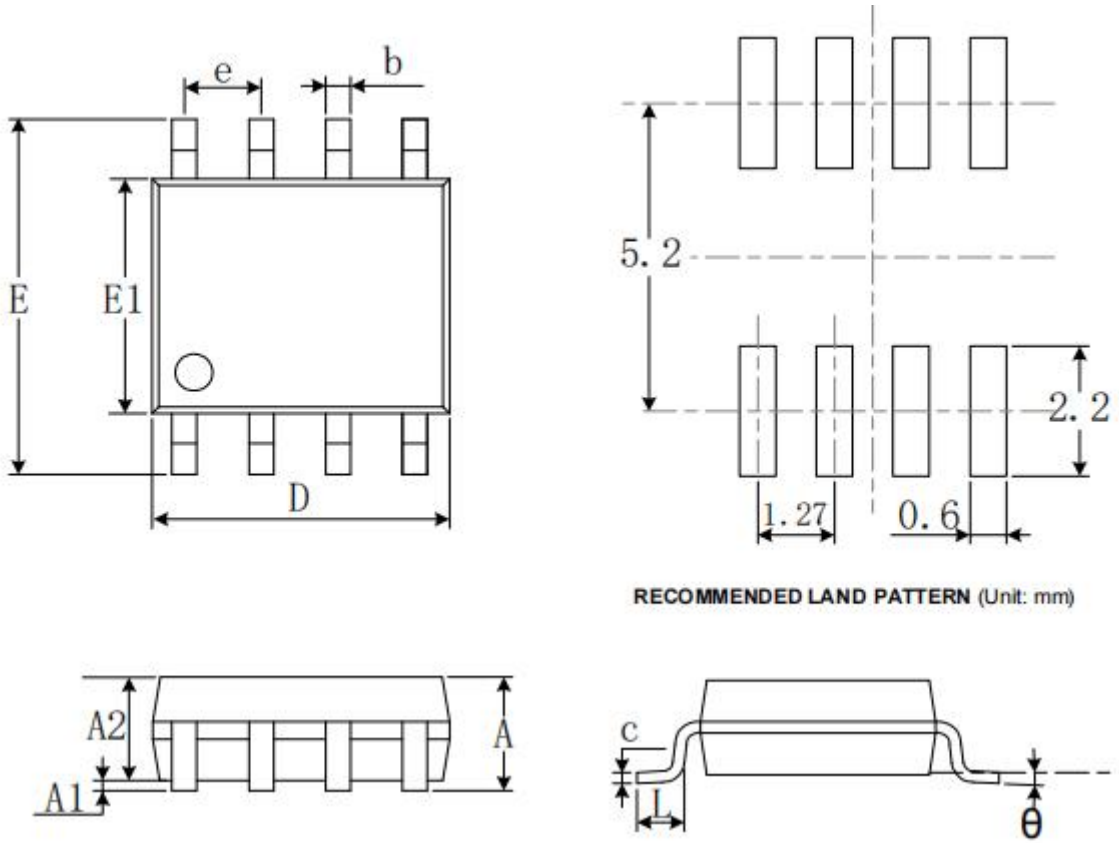
7. Package Information

7.1 DIP8



Symbol	Dimensions In Millmeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	—	—	4.31	—	—	0.170
A1	0.38	—	—	0.015	—	—
A2	3.15	3.40	3.65	0.124	0.134	0.144
B	0.38	0.46	0.51	0.015	0.018	0.020
B1	1.27	1.52	1.77	0.050	0.060	0.070
C	0.20	0.25	0.30	0.008	0.010	0.012
D	8.95	9.20	9.45	0.352	0.362	0.372
E	6.15	6.40	6.65	0.242	0.252	0.262
E1	—	7.62	—	—	0.300	—
e	—	2.54	—	—	0.100	—
L	3.00	3.30	3.60	0.118	0.130	0.142
θ	0°	—	15°	0°	—	15°

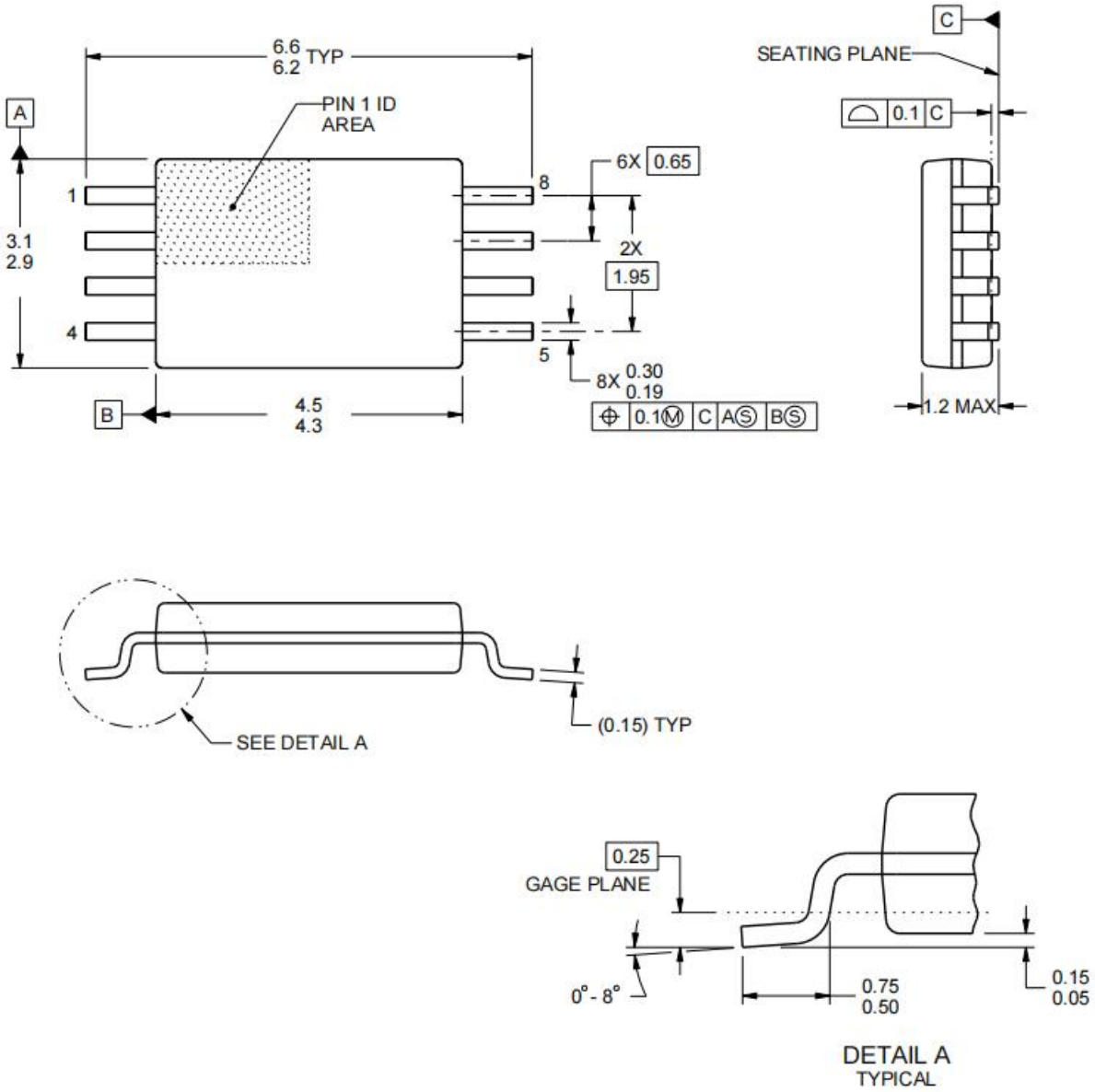
7.2 SOP8



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°

7.3 TSSOP8

Unit: mm



7.4 DFN8L

Unit: mm