

# Dual Operational Amplifier



Rev.1. Jan. 2010.



VSP MIKRON

LM358M

## DESCRIPTION

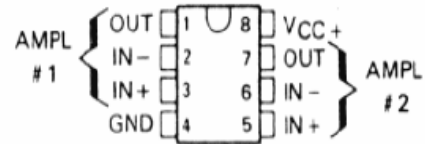
The LM358 consists of two independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

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

## FEATURES

- Wide range of supply voltages
- Low supply current drain independent of supply voltage
- Low input biasing current
- Low input offset voltage and offset current
- Input common-mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- DC voltage gain 100 V/ mV Typ
- Internally frequency compensation

## PACKAGE INFORMATION



## ELECTRICAL CHARACTERISTICS

at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		LM358/ LM358M/ LM358MMK			UNIT
			MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_{CC} = 5\text{ V to MAX}$ , $V_{IC} = V_{ICR\text{ min}}$ , $V_O = 1.4\text{ V}$	25 °C Full range		3 7	7 9	mV
$\alpha V_{IO}$ Average temperature coefficient of input offset voltage		Full range		7		$\mu\text{V}/^\circ\text{C}$
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	25 °C Full range		2 50	50 150	nA
$\alpha I_{IO}$ Average temperature coefficient of input offset current		Full range		10		$\text{pA}/^\circ\text{C}$
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$	25 °C Full range		-20 -250	-250 -500	nA
$V_{ICR}$ Common-mode input voltage range	$V_{CC} = 5\text{ V to MAX}$	25 °C Full range	0 to $V_{CC} - 1.5$ 0 to $V_{CC} - 2$			V
$V_{OH}$ High-level output voltage	$R_L \geq 2\text{ k}\Omega$ (NOTE 1) $V_{CC} = \text{MAX}$ , $R_L = 2\text{ k}\Omega$ $V_{CC} = \text{MAX}$ , $R_L \geq 10\text{ k}\Omega$	25 °C Full range Full range	$V_{CC} - 1.5$ 26 27		28	V
$V_{OL}$ Low-level output voltage	$R_L \geq 10\text{ k}\Omega$	Full range		5	20	mV
$A_{VD}$ Large-signal differential voltage amplification	$V_{CC} = 15\text{ V}$ , $V_O = 1\text{ V to } 11\text{ V}$ , $R_L \geq 2\text{ k}\Omega$	25 °C Full range	25 15	100		V/mV
CMRR Common-mode rejection ratio	$V_{CC} = 5\text{ V to MAX}$ , $V_{IC} = V_{ICR\text{ min}}$	25 °C	65	80		dB
$k_{SVR}$ Supply voltage rejection ratio ( $\Delta V_{CC}/\Delta V_{IO}$ )	$V_{CC} = 5\text{ V to MAX}$	25 °C	65	100		dB
$V_{O1}/V_{O2}$ Crosstalk attenuation	$f = 1\text{ kHz to } 20\text{ kHz}$	25 °C		120		dB
$I_O$ Output current	$V_{CC} = 15\text{ V}$ , $V_{ID} = 1\text{ V}$ , $V_O = 0$ $V_{CC} = 15\text{ V}$ , $V_{ID} = -1\text{ V}$ , $V_O = 15\text{ V}$ $V_{ID} = -1\text{ V}$ , $V_O = 200\text{ mV}$	25 °C Full range 25 °C Full range 25 °C	-20 -10 10 5 12	-30 20		mA    $\mu\text{A}$
$I_{OS}$ Short-circuit output current	$V_{CC}$ at 5 V, GND at -5 V, $V_O = 0$	25 °C		$\pm 40$	$\pm 60$	mA
$I_{CC}$ Supply current (two amplifiers)	$V_O = 2.5\text{ V}$ , No load $V_{CC} = \text{MAX}$ , $V_O = 0.5V_{CC}$ , No load	Full range Full range		0.7 1	1.2 2	mA

- All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. "MAX"  $V_{CC}$  for testing purposes is 30 V. Full range is 0 °C to 70 °C.

Note1 Only for LM358

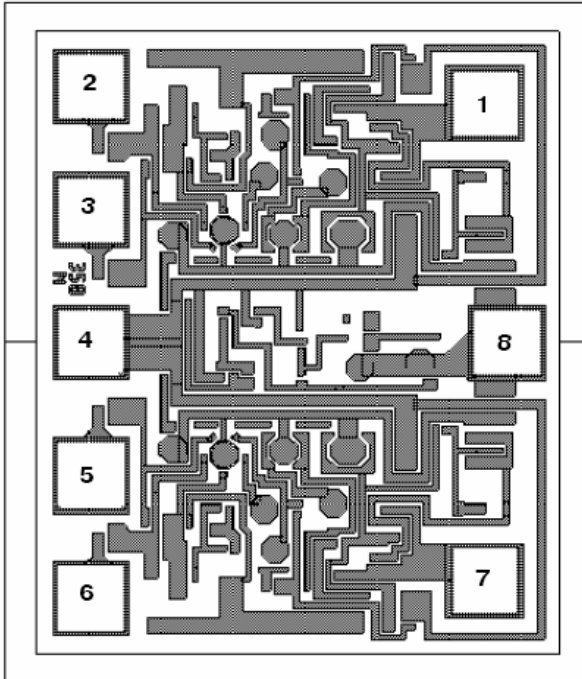
# Dual Operational Amplifier



VSP MIKRON

LM358M

## PAD LOCATION LM358M



Wafer Thickness:  $460 \pm 30 \mu\text{m}$  (or  $350 \pm 30 \mu\text{m}$ ,  
 $280 \pm 30 \mu\text{m}$ )  
 Top metal: AlSi  
 Backside metal: - (or Ti-Ni (V)-Ag)  
 Wafer size: 100 mm

Chip Size:  $0.8 \times 0.95 \text{ mm}^2$

## PAD LOCATION COORDINATES

Pad N	Pad Name	Pad size ( $\mu\text{m} \times \mu\text{m}$ )	Coordinates, $\mu\text{m}$	
			X	Y
1	#1 OUT	95 x 95	657,5	807,5
2	#1 IN-	95 x 95	116,5	831,5
3	#1 IN+	95 x 95	116,5	660,5
4	GND	95 x 95	116,5	475
5	#2 IN+	95 x 95	116,5	289,5
6	#2 IN-	95 x 95	116,5	118,5
7	#2 OUT	95 x 95	657,5	142,5
8	V <sub>CC</sub>	95 x 95	687,5	474,5