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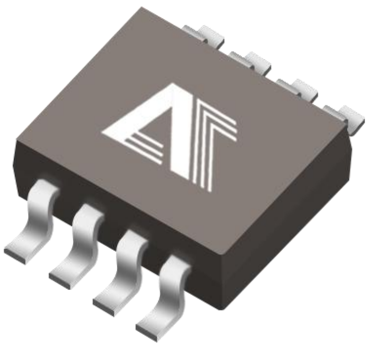


Operational amplifier

LM258DR

Product Data Sheet

AOTE DCC
RELEASE

Summary ：

The LM258 device is an industry-standard operational amplifier featuring two high-voltage (36V) amplifiers. It delivers exceptional value for cost-sensitive applications, with characteristics including low offset voltage (300μV, typical), rail-to-rail common-mode input range, and high differential input voltage capability.

Product features

- The common-mode input voltage range includes ground and supports near-ground direct sensing

Applications

- Commercial network and server power supply units
- Multi functional printer
- Power supply and mobile charger
- Motor control: AC induction, brushed DC, brushless DC, high voltage, low voltage, permanent magnet, and stepper motors
- Desktop computers and motherboards
- Indoor and outdoor air conditioning
- Washing machine, dryer, and refrigerator
- Communication inverters, series inverters, central inverters, and frequency converters
- Uninterruptible power supply
- Electronic point of sale system

Encapsulated Information

Device Model (1)	Encapsulation	Package size (2)
LM258	D(SOIC,8)	4.9mm x 6mm

Note: If there is a discrepancy between the actual product and the ordering information, please refer to the actual product.

Series from Product Comparison Table

Specification	LM258	Unit
Power supply voltage	3 to 30	V
Unbalanced voltage (maximum value at 25 ℃)	±5	mV
Input bias current (typical/maximum)	20/ 15	nA
gain bandwidth product	0.7	MHz
Power supply current (typical value for each channel)	0.35	mA
ESD (HBM)	500	V
Working environment temperature	-25 to 85	℃

The package size (length x width) is the nominal value and includes pins (if applicable)

◆ Pin configuration and functionality

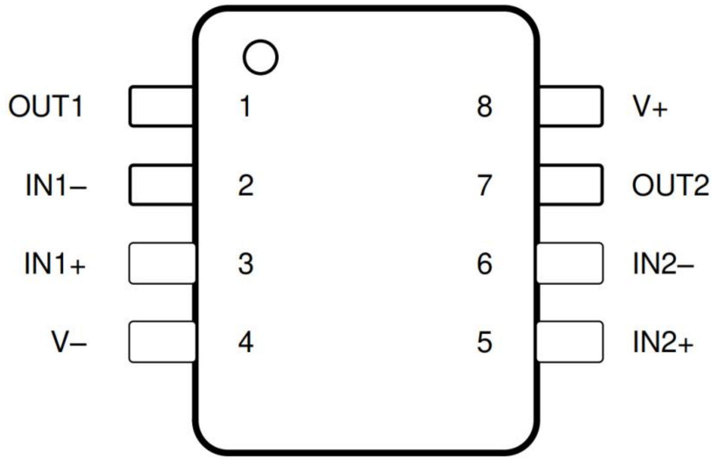


Figure 4-1 D package 8-pin SOIC, SO, top view

Table 4-1 Pin Functions

Pin			I/O	Explanation
Name	**LCCC(1)**	**SOIC、SO、(1)**		
IN1 -	5	2	I	Negative input
IN1+	7	3	I	Positive input
IN2 -	15	6	I	Negative input
IN2+	12	5	I	Positive input
OUT1	2	1	O	Output
OUT2	17	7	O	Output
V -	10	4	--	Negative (minimum) power supply or grounding (for single power supply)
NC	1、3、4、6、8、9、11、13、14、16、18、19	--	--	Not connected to the internal circuit
V+	20	8	--	Positive (highest) power supply

◆ Absolute maximum rated value

Within the temperature range of the working environment (unless otherwise specified)

		Min	Max	Unit
Power supply voltage, V_S = ([V+] - [V-])			±16 or 32	V
input voltage, V_I	Any input	-0.3	40	V
		-0.3	32	
Duration of output short circuit to ground (one amplifier) (Under or below TA=25 ℃ and VS ≤ 15V conditions) (3)			infinite	s
Working environment temperature, T_A		-25	85	℃
Run virtual junction temperature, T_J			150	℃
Storage temperature, T_{stg}		-65	150	℃

(1) Stress exceeding the values listed under the absolute maximum rated value may cause permanent damage to the device. These are only stress ratings and do not indicate that the device can operate normally under these conditions or any other conditions beyond the recommended operating conditions. Prolonged exposure to maximum absolute rated conditions can affect the reliability of the equipment.

(2) Differential voltage is the value on IN+relative to IN -.

(3) A short circuit from output to VS can cause overheating and ultimately result in damage.

◆ ESD level

			Value	Unit
LM258				
$V_{(ESD)}$	Electrostatic Discharge	Human discharge model (HBM), Compliant with ANSI/ESDA/JEDEC JS-001 standard (1)	±500	V
		Charging device model (CDM), Compliant with JEDEC specification JESD22-C101 (2)	±1000	

(1) JEDEC document JEP155 states that safe production can be achieved under standard ESD control procedures at 500V HBM.

(2) JEDEC document JEP157 states that 250V CDM can be safely produced under standard ESD control procedures.

Suggested operating conditions

Measured within the temperature range of the working environment (unless otherwise specified)

		Min	Max	Unit
V_S	Power supply voltage, V_S= ([V+] - [V-])	3	30	V
V_{CM}	Common mode voltage	V -	V+ - 2	V
T_A	Working environment temperature	-20	85	℃

Thermal performance information

Thermal index (1)		LM258 D (SOIC) 8 PINS	Unit
RθJA	Connected to environmental thermal resistance	124.7	℃/W
RθJC(top)	Thermal resistance at the top of the shell	66.9	
RθJB	Connect to the thermal resistance of the circuit board	67.9	
ψT	End to top feature parameters	19.2	
ψB	Based on the characteristic parameters of the circuit board	67.2	
RθJC(bot)	Thermal resistance at the bottom of the shell	—	

◆ Electrical characteristics: LM258

Under the conditions of V_S=(V+) - (V -)=5V and T_A=25 ℃ (unless otherwise specified)

parameter		Test conditions (1)		Min	Typ(2)	Max	Unit
Offset voltage							
V_{OS}	Input offset voltage	V_S= 5V至30V; V_{CM} = 0V; V_O = 1.4V					mV
			T_A = -25℃ to 85℃				
$d_{V_{OS}}/d_T$	Input offset voltage drift		T_A= -25℃ to 85℃				μV/℃
PSRR	The relationship between input offset voltage and power supply voltage ($\Delta V_{IO}/\Delta V_S$)	V_S=5 V至30 V					dB
V_{O1}/V_{O2}	Channel separation	f =1kHz to 20kHz					dB
Input voltage range							
V_{CM}	Common mode voltage range	V_S=5 V至30 V		(V-)		(V+)-1.5	V
		V_S=5 V至30 V	T_A = -25℃ to 85℃	(V-)		(V+)-2	
CMRR	Common mode rejection ratio	V_S =5V至30V; V_{CM} = 0V		70	80		dB
Input bias current							
I_B	Input bias current	V_O = 1.4V			-20	-150	nA
			T_A = -25℃ to 85℃			-300	
I_{OS}	Input offset current	V_O = 1.4V			2	30	nA
			T_A = -25℃ to 85℃			100	
dI_{OS}/d_T	Input offset current drift				10		pA/℃
Noise							
e_n	Input voltage noise density	f = 1kHz			40		nV/√Hz
Open-loop gain							
A_{OL}	Loop voltage gain	V_S =15V; V_O =1V to 11V; R_L ≥ 2kΩ		50	100		V/mV
				25			
Frequency response							
GBW	gain bandwidth product				0.7		MHz
SR	slew rate	G = +1			0.3		V/μs

parameter		Test conditions [1]			Min	Typ	Max	Unit
Output								
V_O	Voltage output swing of self power rail	Positive power rail	V_S = 30V; R_L = 2kΩ	T_A = -25℃ to 85℃			4	V
			V_S = 30V; R_L ≥10kΩ			2	3	
			V_S = 5V; R_L ≥ 2kΩ			5	1.5	
		Negative power rail	V_S = 5V; R_L ≤10kΩ	T_A = -25℃ to 85℃	-20	-30		mV
I_O	Output Current	V_S = 15V; V_O = 0V; V_{ID} = 1V	Draw current				-60	mA
				T_A = -25℃ to 85℃	-10			
		V_S = 15V; V_O = 15V; V_{ID} =-1V	Sink current		10	20		
				T_A = -25℃ to 85℃	5			
		V_{ID} = -1V; V_O = 200mV			12	30		μA
I_{SC}	short-circuit current	V_S = 10V; V_O = V_S / 2				±40	±60	mA
power supply								
I_Q	Static current of each amplifier	V_O = 2.5V; I_O = 0A		T_A = -25℃ to 85℃		350	600	μA
		V_S = 30V; V_O = 15V; I_O = 0A				500	1000	

(1) Unless otherwise specified, all characteristics are measured at zero common mode input voltage under open-loop conditions. For LM258 and LM258A, the maximum VS used for testing purposes is 30V.

◆ Typical characteristics

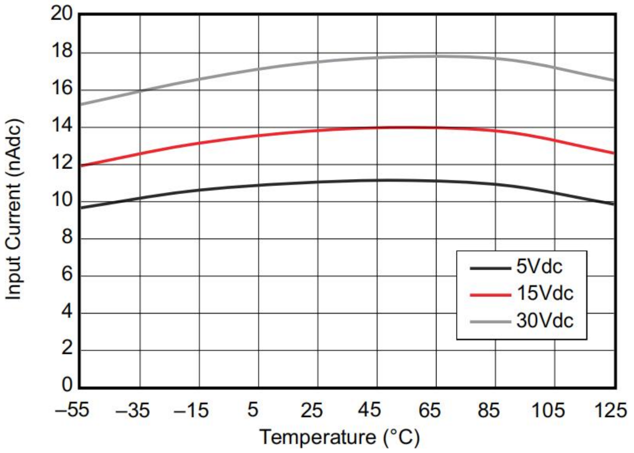


Figure 5-39 The relationship between input current and temperature

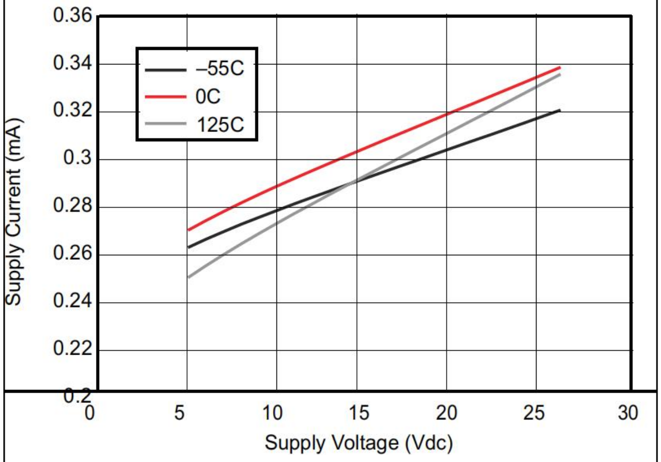


Figure 5-40The relationship between power supply current andpower supply voltage

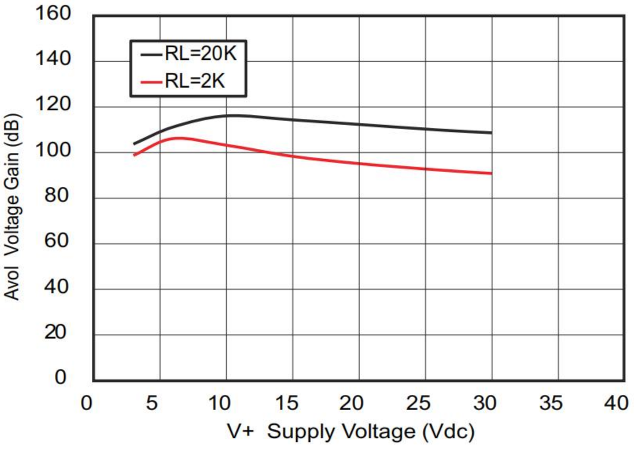


Figure 5-41 The relationship between voltage gain and power supply voltage

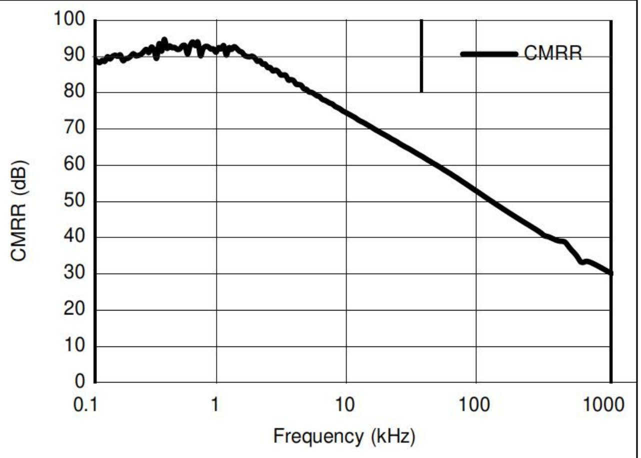


Figure 5-42 The relationship between common mode rejection ratio and frequency

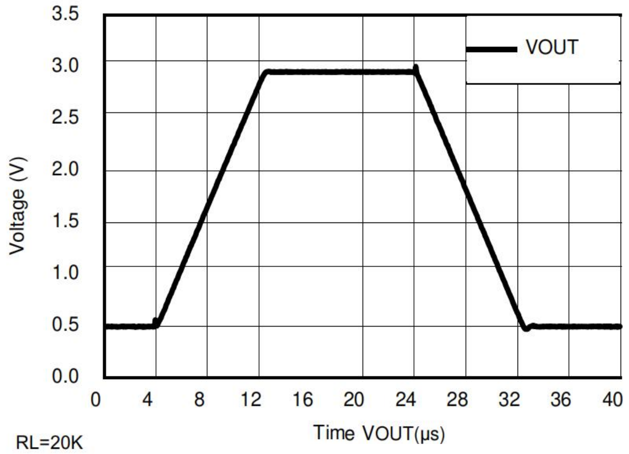


Figure 5-43 Voltage follower large signal pulse response (50pF)

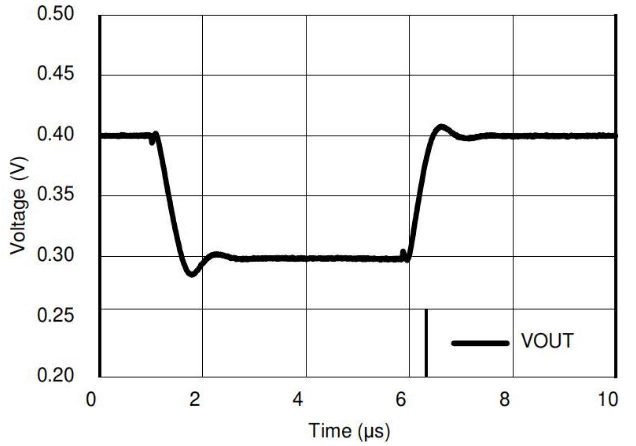


Figure 5-44 Voltage follower small signal response (50pF)

◆ Typical Characteristics (Continued)

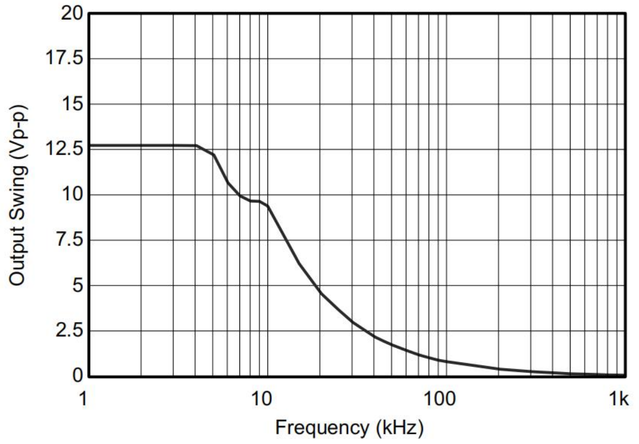


Figure 5-45 The relationship between maximum output swing and frequency (VCC=15V)

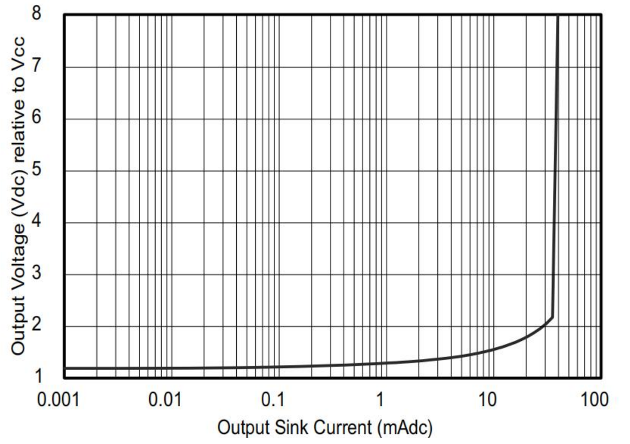


Figure 5-46 Output current characteristics

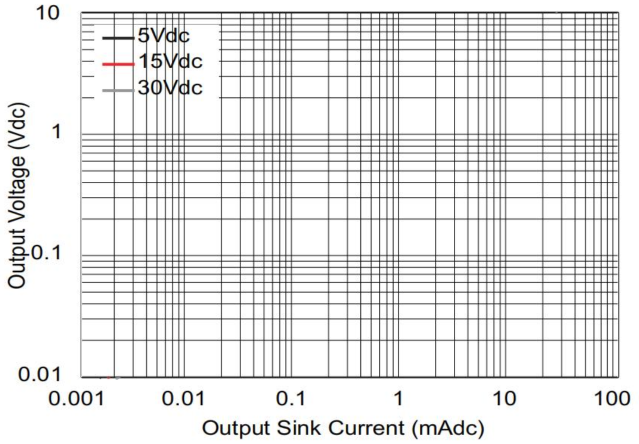


Figure 5-47 Output current characteristics

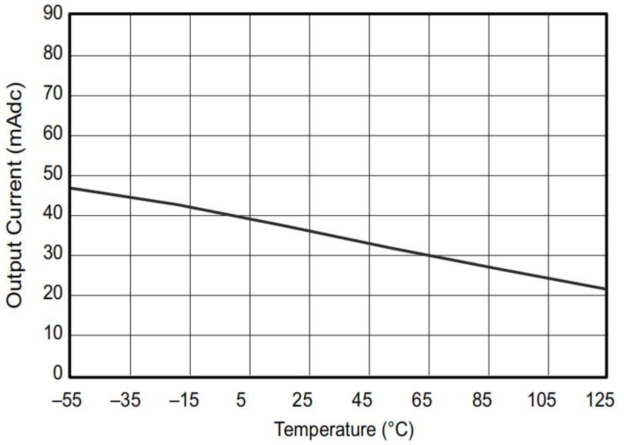


Figure 5-48 Pull current limit

◆ Parameter measurement information

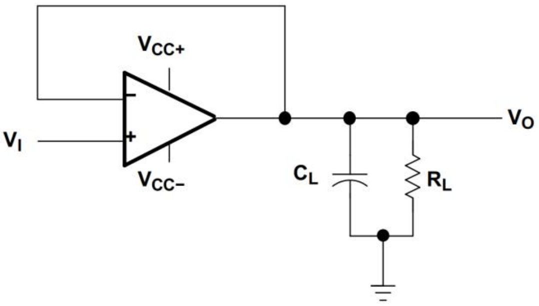


Figure 6-1 Unity gain amplifier

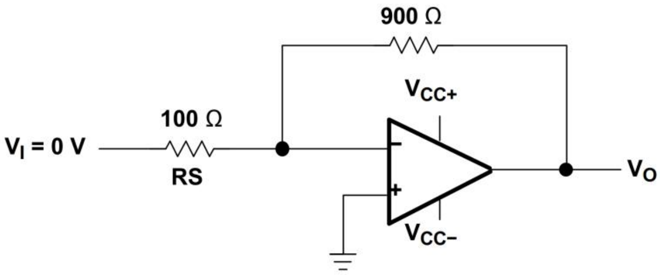


Figure 6-2 Noise testing circuit

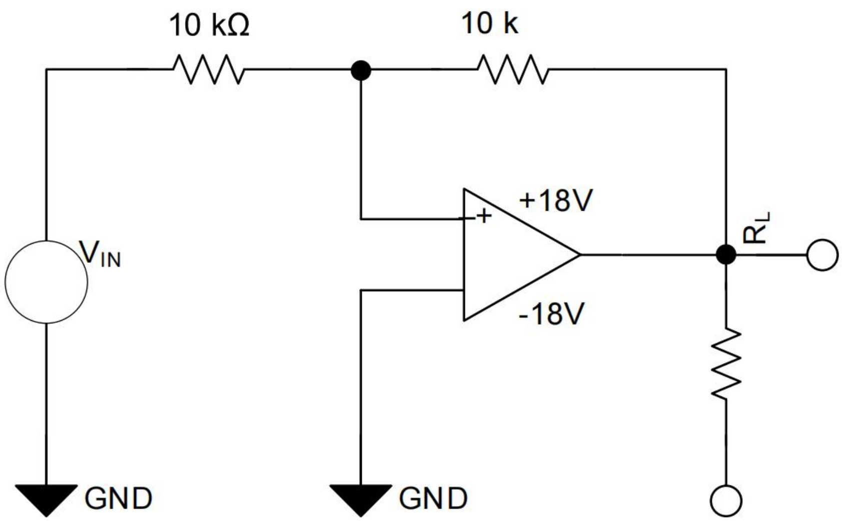


Figure 6-3 Test circuit for THD+N and small signal step response (G=-1)

Application and Implementation

Remarks

The information in the following application section does not belong to the AOTE component specifications, and AOTE does not guarantee its accuracy or completeness. AOTE customers are responsible for determining whether each component is suitable for their application. Customers should verify and test their design implementation to confirm system functionality.

Application Information

The LM258 operational amplifier is suitable for various signal conditioning applications. It can be powered at the input before V_S, enabling flexibility in multi-power supply circuits.

Typical Applications

The typical application of an operational amplifier is the inverting amplifier. This amplifier accepts a positive voltage at the input and then converts it into a negative voltage of the same magnitude. It also converts a negative input voltage into a positive voltage in the same manner.

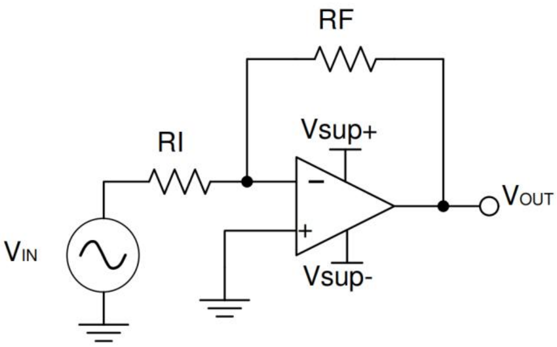


Figure 8-1. Application schematic

Design Requirements

The selected power supply voltage must be greater than the input voltage range and output range. For example, this application extends the signal from ± 0.5V to ± 1.8V. Setting the power supply to ± 12V is sufficient to meet the requirements of this application.

Detailed design process

Use equations 1 and 2 to determine the required gain for the inverting amplifier.

$$A_V \quad \frac{VOUT}{VIN} \tag{1}$$

$$A_V = \frac{1.8}{-0.5} = -3.6 \tag{2}$$

After determining the required gain, choose the resistance of R_I or R_F. [The subscripts should also be fixed on the corresponding numbers and formulas.] As amplifier circuits use milliampere level currents, it is usually necessary to choose kiloohm level resistance values. This ensures that the device does not consume too much current. The R_I used in this example is 10kΩ, which means 36k Ω is used for R_F. This is calculated from equation 3.

$$A_V = -\frac{RF}{RI} \tag{3}$$

  Release Date :April 7, 2026 www.aotesemi.com 版本：B1

Application Curve

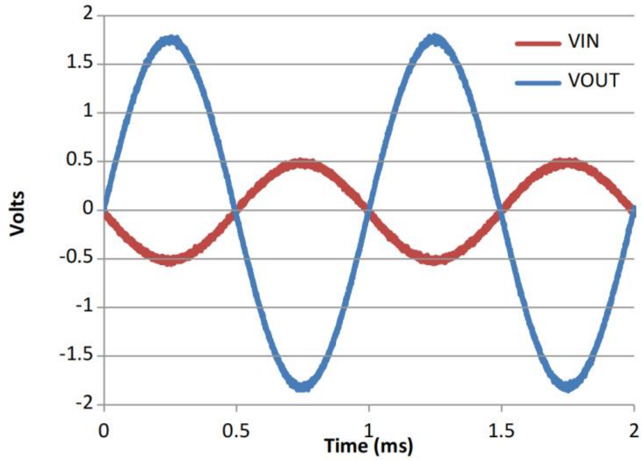


Figure 8-2. Input and output voltages of inverting amplifier

Suggestions related to power supply

Careful

A power supply voltage greater than the recommended rated operating range may cause permanent damage to the device (please refer to the absolute maximum rated value).

Place a 0.1 μ F bypass capacitor near the power supply pin to reduce errors coupled in from high noise or high impedance power supplies. For more detailed information on the placement of bypass capacitors, please refer to section 8.4.

layout

Layout Guide

In order to achieve higher performance of the device, good PCB layout practices should be used, including:

- Noise can be transmitted to the analog circuit through all circuit power pins and the operational amplifier itself. Bypass capacitors are used for local simulation The circuit provides a low impedance power supply to reduce coupling noise.
- Connect a low ESR 0.1 μ F ceramic bypass capacitor between each power pin and ground terminal, and place it as close to the device as possible. Regarding single For power applications, a single bypass capacitor can be connected between V+and the ground terminal.
- Grounding the analog and digital parts of a circuit separately is one of the simplest and most effective methods for noise suppression. On multi-layer PCB One or more layers are typically used specifically as grounding planes. The grounding layer helps with heat dissipation and reduces EMI noise pickup. Ensure logarithms Physical isolation should be carried out between word grounding and analog grounding, and attention should be paid to grounding current.
- To reduce parasitic coupling, input wiring should be kept as far away as possible from power or output wiring. If these traces cannot maintain a separated state, it is best to have sensitive traces intersect with noisy traces vertically rather than parallel.
- External components should be placed as close as possible to the device. Bringing RF and RG closer to the inverting input can minimize parasitic capacitance to the greatest extent possible (as shown in the layout example).

- Minimize the length of input wiring as much as possible. Remember, input wiring is the most sensitive part of the circuit.
- Consider setting up driver type low impedance protection rings around critical wiring. This can significantly reduce the leakage current generated by nearby wiring at different potentials.

Layout Example

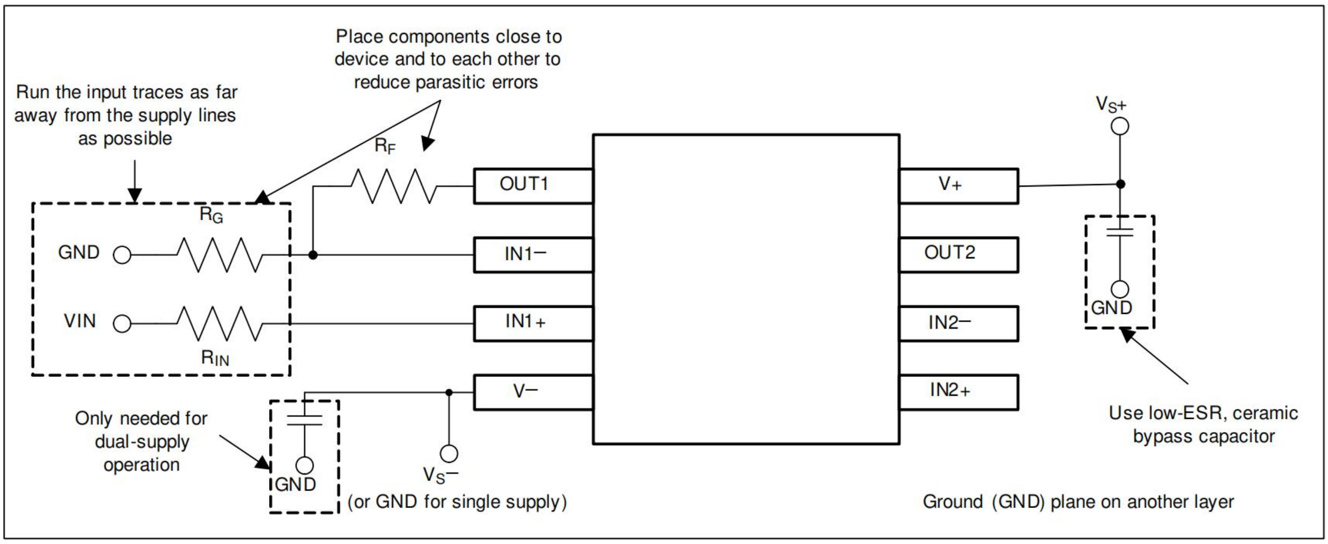


Figure 8-3. Layout of operational amplifier circuit board with non inverting configuration

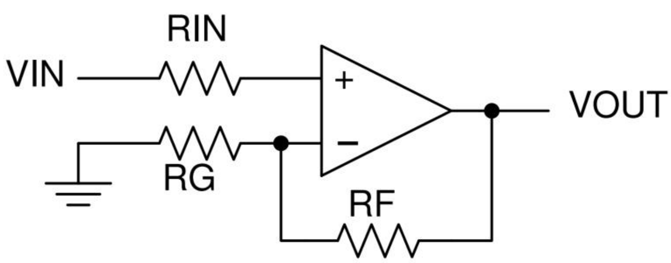


Figure 8-4. Schematic diagram of operational amplifier with in-phase configuration

Static discharge warning

Electrostatic discharge (ESD) can damage this integrated circuit. AOTE Semiconductor recommends handling all integrated circuits through appropriate preventive measures. If the correct handling and installation procedures are not followed, it may damage the integrated circuit.

ESD damage can range from minor performance degradation to overall device failure. Precision integrated circuits may be more susceptible to damage, as even very subtle parameter changes can result in the device not matching its published specifications.

◆ Packaging Information

Orderable part number	Status (1)	Material Type (2)	ckage | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball Material (4)	MSL rating /Peak Reflow(5)	Op temp (℃)	Part marking (6)
LM258DR	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258
LM258DR.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258
LM258DR.B	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258
LM258DRG3	Obsolete	Production	SOIC (D) | 8	-	-	Call AOTE	Call AOTE	-25 to 85	LM258
LM258DRG4	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258
LM258DRG4.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258
LM258DRG4.B	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-25 to 85	LM258

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance,reliability performance testing , and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the AOTE RoHS Statement for additional information and value definition.

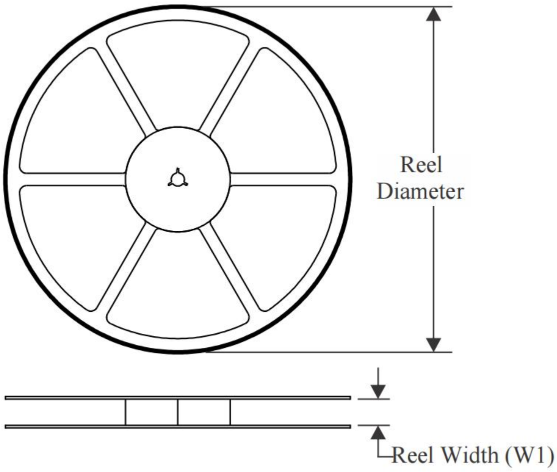
(4) Lead finish/Ball material: Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown.Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

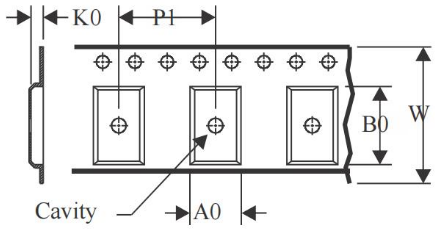
(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

◆ Product packaging information

REEL DIMENSIONS

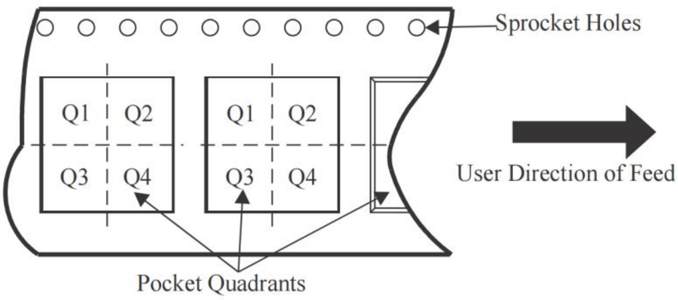


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal sizes

Device	Package Type	PackageDrawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM193DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM193DR	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM193DRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

◆ Attention

- AOTE implements dynamic technical updates. Specifications are subject to change. Refer to the official website for the latest version.
- Users must strictly adhere to specified conditions. Failures caused by misuse (overload, high temperature, incompatible circuits) are excluded from warranty.
- Contact technical support for customized validation in critical applications (medical devices, industrial control).
- This document is valid until December 31, 2026. Updates will be notified on the official website.
- For further clarification on technical specifications or application solutions, please contact us through official channels: