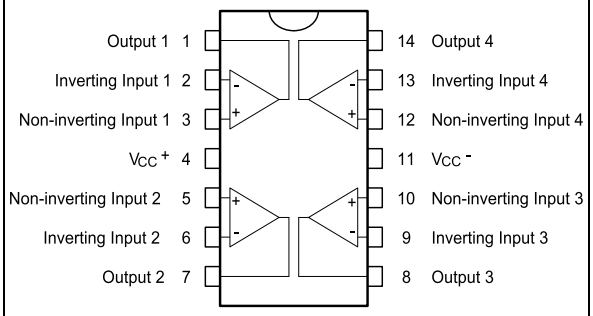
LM248, LM348

Four UA741 quad bipolar operational amplifiers

Datasheet - production data

D
SO14



Pin connections (top view)

Features

- Low supply current: 0.53 mA per amplifier
- Class AB output stage: no crossover distortion
- Pin compatibility with LM124, LM224, LM324
- Low input offset voltage: 1 mV
- Low input offset current: 2 nA
- Low input bias current: 30 nA
- Gain bandwidth product: 1.3 MHz
- High degree of isolation between amplifiers: 120 dB
- Overload protection for inputs and outputs

Description

The LM248 and LM348 consist of four independent, high-gain internally-compensated, low-power operational amplifiers which have been designed to provide functional characteristics identical to those of the familiar UA741 operational amplifier. In addition, the total supply current for all four amplifiers is compatible with the supply current of a single UA741 type operational amplifier. Other features include input offset current and input bias current which are much less than those of a standard UA741. Also, excellent isolation between amplifiers has been achieved by independently biasing each amplifier and using layout techniques which minimize thermal coupling.

The LM248 and LM348 can be used where multiple UA741 type amplifiers are being used and in applications where amplifier matching or high packaging density is required.

Table 1. Device summary

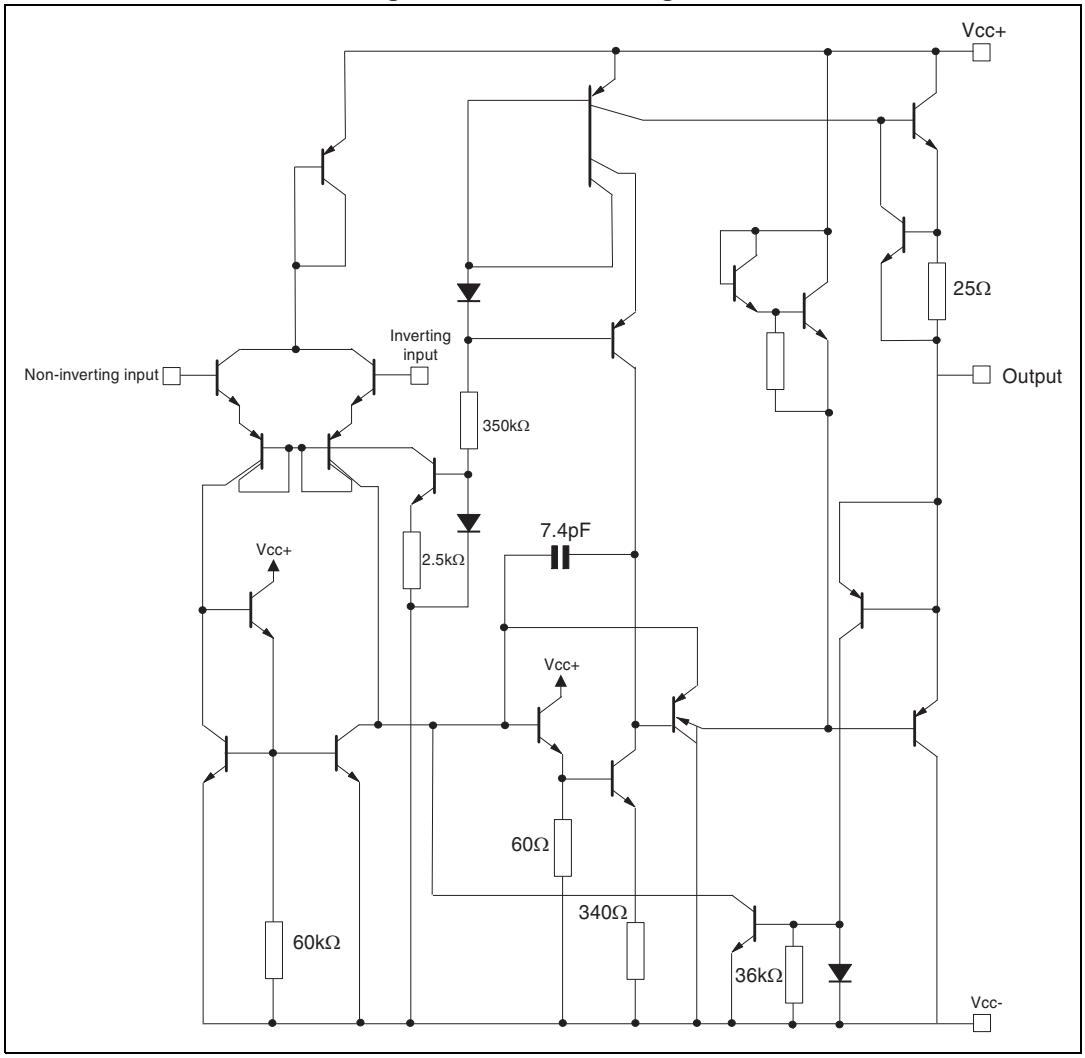
Part number	Temperature range	Package
LM248	-40 °C to 105 °C	D(1)
LM348	0 °C to 70° C	
Order code example: LM348DT(2)		

1. D = Small outline package (SO)
2. See *Table 5: Order codes*

Contents

1 Schematic diagram

Figure 1. Schematic diagram



2 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameters	LM248	LM348	Unit
V_{CC}	Supply voltage	±22		V
V_i	Input voltage(1)			
V_{id}	Differential input voltage	±44		
	Output short-circuit duration(2)	Infinite		-
P_{tot}	Power dissipation	500		mW
T_{oper}	Operating free-air temperature range	-40 to 105	0 to 70 C	°C
T_{stg}	Storage temperature range	-65 to 150		
ESD	HBM: human body model(3)	200		V
	MM: machine model(4)	50		
	CDM: charged device model(5)	1.5		kV

1. For supply voltages less than the maximum value, the absolute maximum input voltage is equal to the supply voltage.
2. Any of the amplifier outputs can be shorted to ground indefinitely, however, more than one should not be simultaneously shorted as the maximum junction will be exceeded.
3. Human body model: 100pF discharged through a 1.5kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
4. Machine model: a 200pF cap is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5Ω), done for all couples of pin combinations with other pins floating.
5. Charged device model: all pins plus package are charged together to the specified voltage and then discharged directly to the ground.

3 Electrical characteristics

Table 3. Electrical performances at V_{CC} = ± 15 V, T_{amb} = 25 °C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage ($R_s \leq 10$ kΩ), T_{amb} = 25 °C		1	5	mV
	Input offset voltage ($R_s \leq 10$ kΩ), $T_{min} \leq T_{amb} \leq T_{max}$			6	
I_{io}	Input offset current, T_{amb} = 25 °C		2	25	nA
	Input offset current, $T_{min} \leq T_{amb} \leq T_{max}$			75	
I_{ib}	Input bias current, T_{amb} = 25 °C		30	100	
	Input bias current, $T_{min} \leq T_{amb} \leq T_{max}$			300	
A_{vd}	Large signal voltage gain (V_o = ±10 V, R_L = 2 kΩ), T_{amb} = 25 °C	50	160		V/mV
	Large signal voltage gain (V_o = ±10 V, R_L = 2 kΩ), $T_{min} \leq T_{amb} \leq T_{max}$	25			
SVR	Supply voltage rejection ratio ($R_s \leq 10$ kΩ), T_{amb} = 25 °C	77	100		dB
	Supply voltage rejection ratio ($R_s \leq 10$ kΩ), $T_{min} \leq T_{amb} \leq T_{max}$				
I_{cc}	Supply current, all amp, no load, T_{amb} = 25 °C		2.1	3.6	mA
	Supply current, all amp, no load, $T_{min} \leq T_{amb} \leq T_{max}$			4.8	
V_{icm}	Input common mode voltage range, T_{amb} = 25 °C	±12			V
	Input common mode voltage range, $T_{min} \leq T_{amb} \leq T_{max}$				
CMR	Common mode rejection ratio ($R_s \leq 10$ kΩ), T_{amb} = 25 °C	70	110		dB
	Common mode rejection ratio ($R_s \leq 10$ kΩ), $T_{min} \leq T_{amb} \leq T_{max}$				
I_{os}	Output short-circuit current, T_{amb} = 25 °C	10	25	35	mA
$\pm V_{opp}$	Output voltage swing, T_{amb} = 25°C, $R_L \leq 10$ kΩ	12	13		V
	Output voltage swing, T_{amb} = 25°C, $R_L \leq 2$ kΩ	10	12		
	Output voltage swing, $T_{min} \leq T_{amb} \leq T_{max}$, $R_L \leq 10$ kΩ	12			
	Output voltage swing, $T_{min} \leq T_{amb} \leq T_{max}$, $R_L \leq 2$ kΩ	10			
SR	Slew rate (V_I = ±10 V, R_L = 10 kΩ, C_L = 100 pF, unity gain)	0.25	0.5		V/µs

Table 3. Electrical performances at V_{CC} = ± 15 V, T_{amb} = 25 °C (unless otherwise specified) (continued)

Symbol	Parameter	Min.	Typ.	Max.	Unit
t_r	Rise time (V_I = ±10 V, R_L = 10 kΩ, C_L = 100 pF, unity gain)		0.3		µs
K_{OV}	Overshoot (V_I = ±10 V, R_L = 10 kΩ, C_L = 100 pF, unity gain)		5		%
R_I	Input resistance	0.8	2.5		MΩ
GBP	Gain bandwidth product (V_I = 10 mV, R_L = 10 kΩ, C_L = 100 pF, f = 100 kHz)	0.7	1.3		MHz
THD	Total harmonic distortion (f = 1 kHz, A_v = 20 dB, R_L = 10 kΩ, C_L = 100pF, V_o = 2 V_{pp})		0.08		%
e_n	Equivalent Input noise voltage (f = 1 kHz, R_s = 100 Ω		40		$\frac{nV}{\sqrt{Hz}}$
V_{o1}/V_{o2}	Channel separation		120		dB

4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK® is an ST trademark.

4.1 SO14 package information

Figure 2. SO14 package mechanical drawing

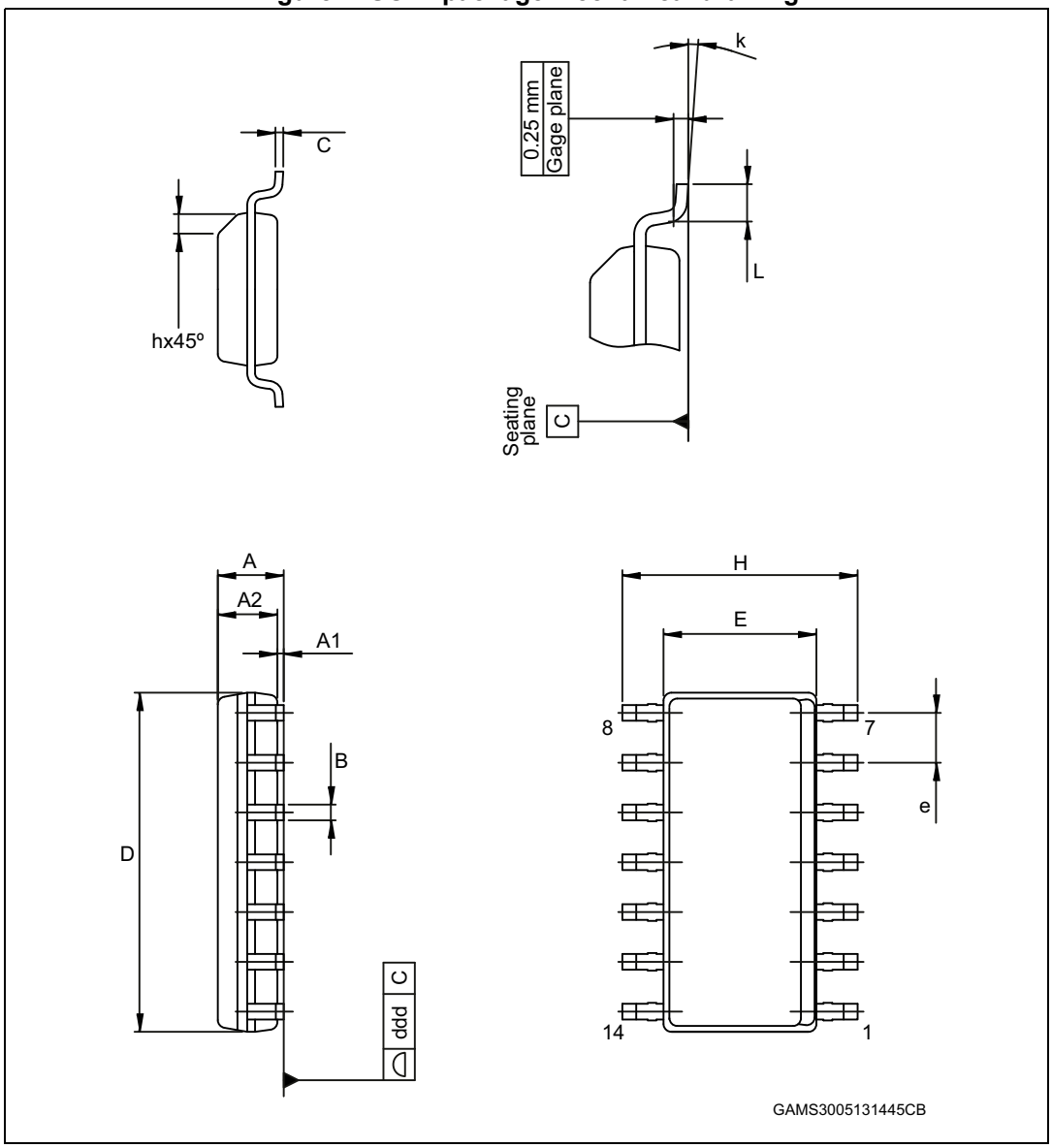


Table 4. SO14 package mechanical data

Ref	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.004		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D(1)	8.55		8.75	0.337		0.344
E	3.80		4.00	0.150		0.157
e	1.27			0.050		
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	0		8	0		0.315
ddd			0.10			0.004

1. Dimension “D” does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions or gate burrs should not exceed 0.15 mm per side.

5 Ordering information

Table 5. Order codes

Order code	Temperature range	Package	Packaging	Marking
LM248D	-40 °C to 105 °C	SO14	Tube	248
LM248DT			Tape and reel	
LM348DT	0 °C to 70° C	SO14	Tape and reel	348

6 Revision history

Table 6. Document revision history

Date	Revision	Changes
05-Jun-2013	4	*Description*: small text changes *Table 1: Device summary*: updated layout Replaced *Figure 2: DIP14 package mechanical drawing*, *Figure 2: SO14 package mechanical drawing*, *Table 4: DIP14 package mechanical data*, and *Table 4: SO14 package mechanical data*. Added *Section 5: Ordering information*
06-Dec-2013	5	Removed LM148 - product obsolete Removed DIP14 package (not recommended for new design) and order codes relating to it (LM148N, LM348N). *Table 2: Absolute maximum ratings*: added ESD data