DATA SHEET

SA58602
High precision operational amplifier

Product data
Supersedes data of 2001 Oct 03

2002 Nov 13

Philips
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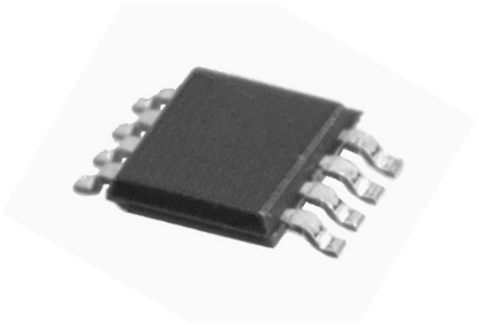
High precision operational amplifier SA58602

GENERAL DESCRIPTION

The SA58602 is a low voltage, high precision dual operational amplifier. The input offset voltage is typically 100 μV with a very low temperature drift of ± 1 μV/°C. The SA58602 supply current is typically 100 μA per amplifier, and it operates from 1.8 V to 6 V single supply.

Having single power supply capability, low current consumption, low offset voltage, low input offset current and low input bias current, the SA58602 is ideal for battery powered applications. It is excellent for precision amplifiers in portable instrumentation equipment used for test and measurement, medical monitors and diagnostics, and remote meters and sensors.



FEATURES

- Functionality to 1.8 V typical
- Low supply current: 100 μA per amplifier (typical)
- Very low input offset voltage: 100 μV (typical)
- Very low input offset drift: ±1 μV/°C (typical)
- Low input offset current: 1 nA (typical)
- Low input bias current: 50 nA (typical)
- Open loop gain: 100 dB (typical)
- Common mode input includes ground

APPLICATIONS

- Signal conditioning and sensing amplification
- Portable instrumentation: Test & measurement, medical monitors and diagnostics, remote meters
- Error amplifiers
- Communications: Pagers, cellular phones, LAN, 5 V datacom bus
- Security systems
- Transducer buffer amplifier

SIMPLIFIED DEVICE DIAGRAM

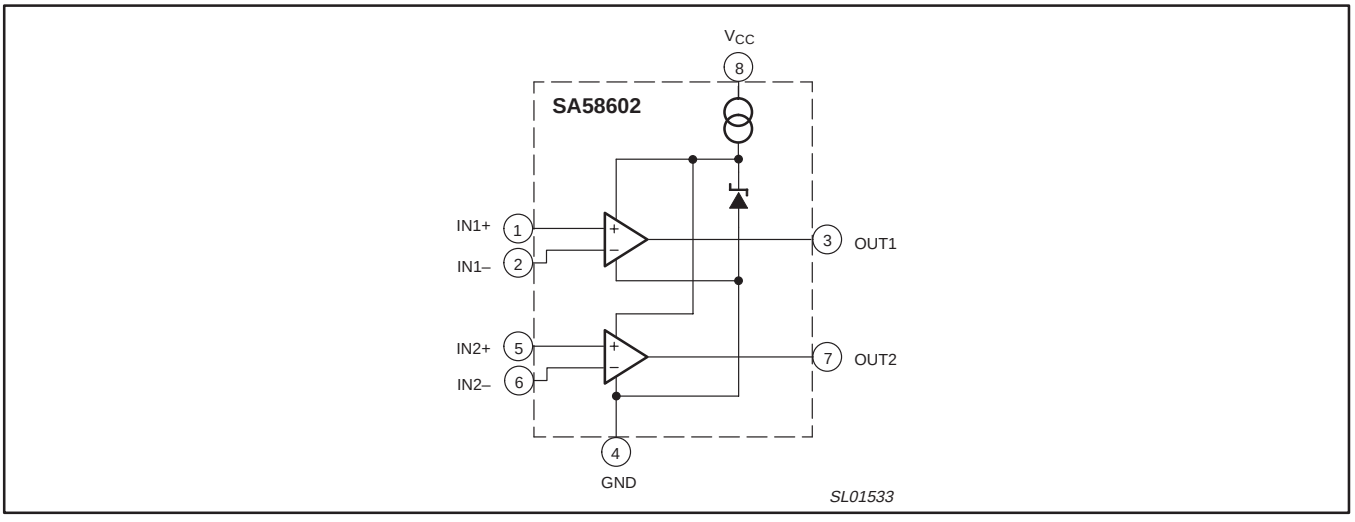


Figure 1. Simplified device diagram.

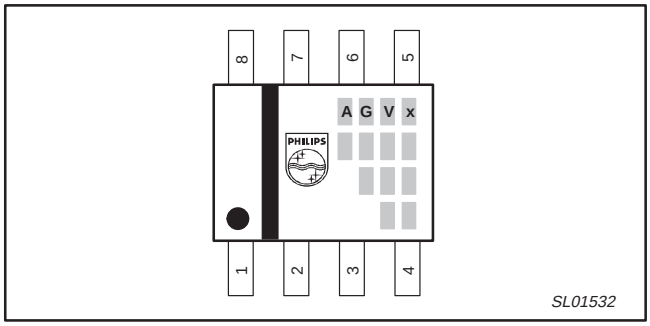
ORDERING INFORMATION

TYPE NUMBER	PACKAGE		TEMPERATURE RANGE
	NAME	DESCRIPTION	
SA58602D	SO8	plastic small outline package; 8 leads; body width 3.9 mm	–40 to +85 °C

Part number marking

Each device is marked with three or four lines of alphanumeric codes. The first three letters of the top line designate the product. The fourth letter, represented by 'x', is a date tracking code. The remaining lines of characters are internal manufacturing codes.

Part number	Marking
SA58602	A G V x



PIN CONFIGURATION

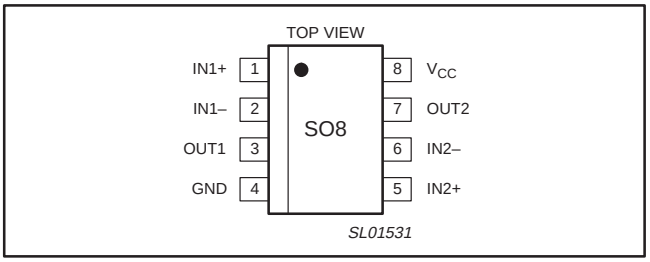


Figure 2. Pin configuration.

PIN DESCRIPTION

PIN	SYMBOL	DESCRIPTION
1	IN1+	Non-inverting input of Amp 1
2	IN1–	Inverting input of Amp 1
3	OUT1	Output of Amp 1
4	GND	Ground
5	IN2+	Non-inverting input of Amp 2
6	IN2–	Inverting input of Amp 2
7	OUT2	Output of Amp 2
8	V_{CC}	Positive supply

MAXIMUM RATINGS

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CC}	Single supply voltage	–0.3	+10	V
V_{IN}	Input voltage	–0.3	+10	V
T_{stg}	Storage temperature	–40	+125	°C
T_{amb}	Operating temperature	–40	+85	°C
P	Power dissipation	–	300	mW

ELECTRICAL CHARACTERISTICS

V_{CC} = 3.0 V, V_{IN} = 0 V, and T_{amb} = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CC}	Supply current		–	0.1	0.15	mA
PSRR	Power supply rejection ratio	f = 100 Hz	50	60	–	dB
V_{CC}	Power supply voltage operating range		1.8	3.0	6.0	V
V_{IN}	Input voltage range		–0.2	–	0.3	V
V_{IO}	Input offset voltage		–	±0.1	±0.35	mV
$\Delta V_{IO}/\Delta T$	Input offset voltage temperature drift	T_{amb} = –20 to +75 °C	–	±1	±3	µV/°C
I_{IO}	Input offset current		–	1	10	nA
$I_{i(bias)}$	Input bias current		–	50	150	nA
$G_{v(ol)}$	Open-loop voltage gain		80	100	–	dB
I_O	Output current	V_{IN} = 10 mV; V_O = 0.5 V	0.5	–	–	mA
V_O	Output voltage swing	V_{IN} = –5 to +25 mV; R_L = 10 kΩ	0.01	–	V_{CC} – 1.0	V

TYPICAL CHARACTERIZATION CURVES

Unless otherwise specified, V_{CC} = 3.0 V, V_{IN} = 0 V, and T_{amb} = 25 °C.

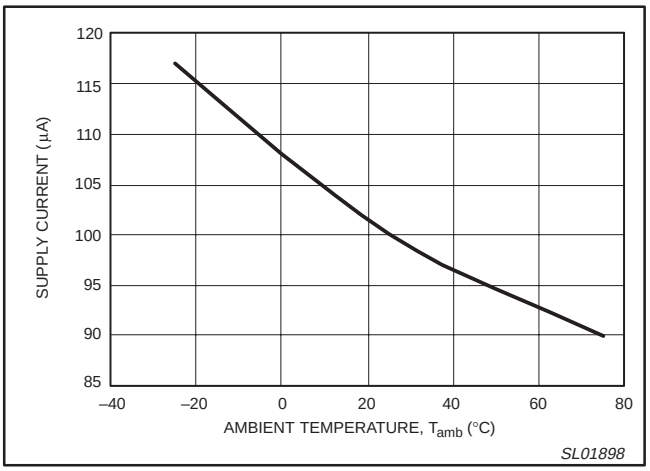


Figure 3. Supply current versus ambient temperature.

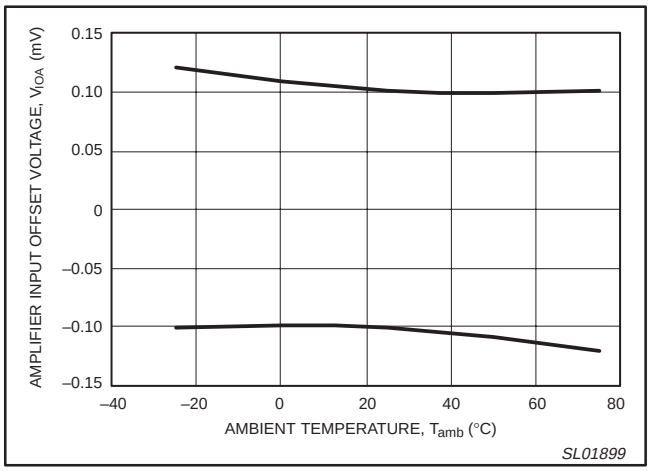


Figure 4. Amplifier input offset voltage versus ambient temperature.

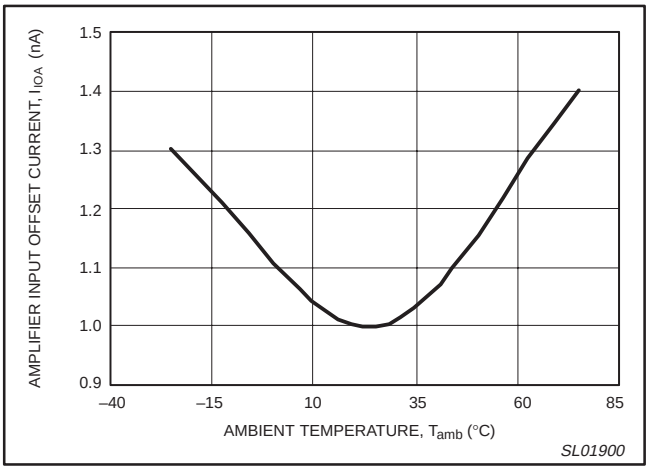


Figure 5. Amplifier input offset current versus ambient temperature.

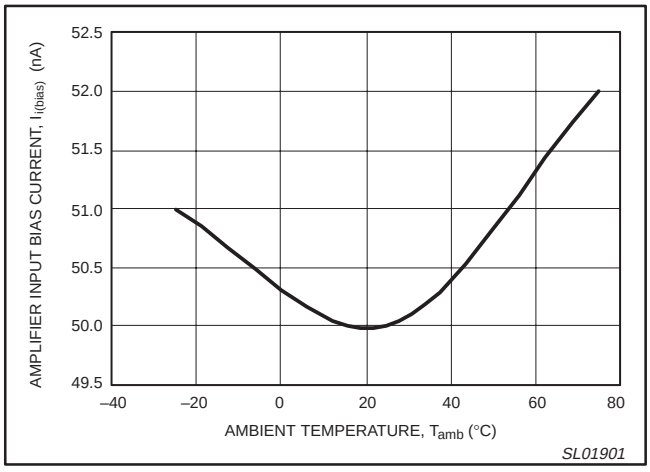


Figure 6. Amplifier input bias current versus ambient temperature.

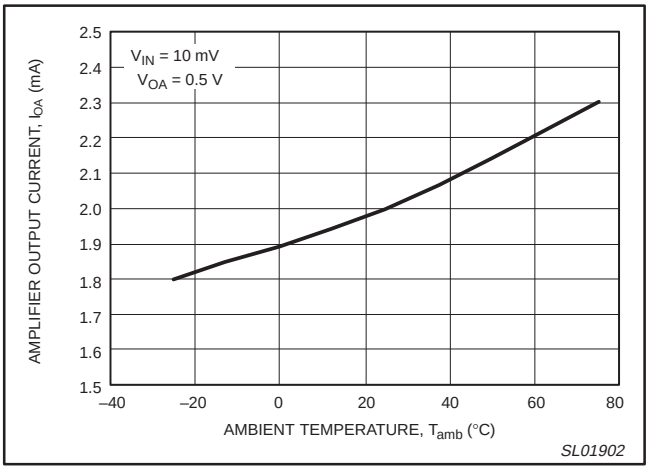


Figure 7. Amplifier output current versus ambient temperature.

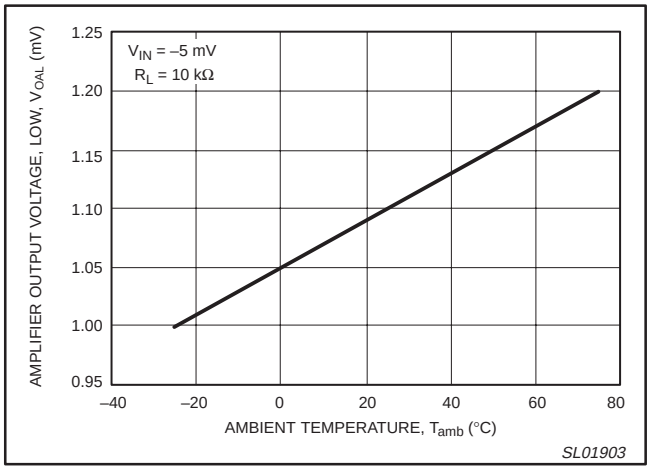


Figure 8. Amplifier output voltage, low versus ambient temperature.

TYPICAL CHARACTERIZATION CURVES *(continued)*

Unless otherwise specified, V_{CC} = 3.0 V, V_{IN} = 0 V, and T_{amb} = 25 °C.

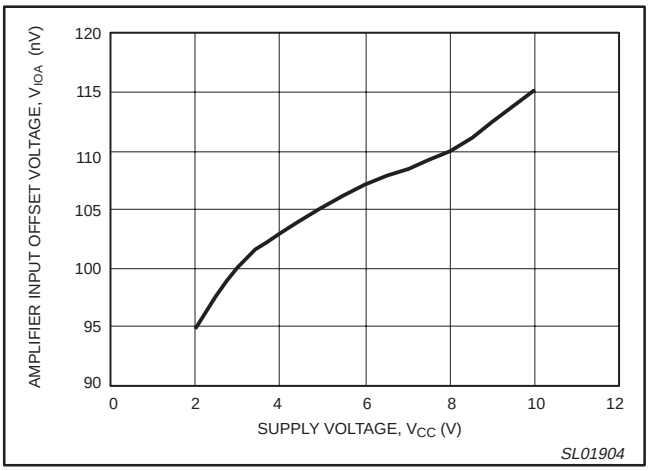


Figure 9. Amplifier offset voltage versus supply voltage.

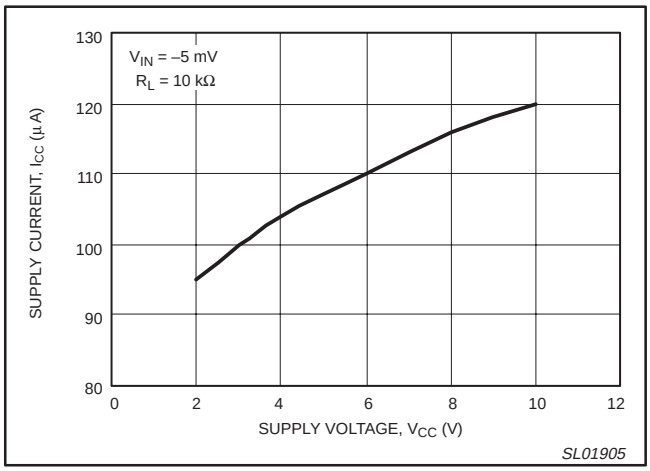


Figure 10. Supply current versus supply voltage.

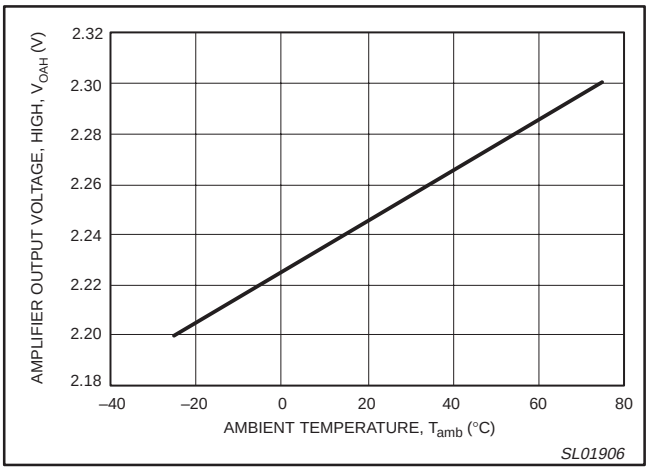


Figure 11. Amplifier input offset current versus supply voltage.

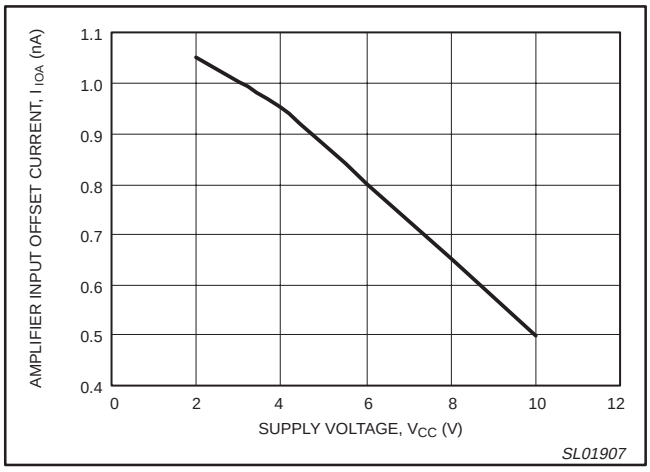


Figure 12. Amplifier input offset current versus supply voltage.

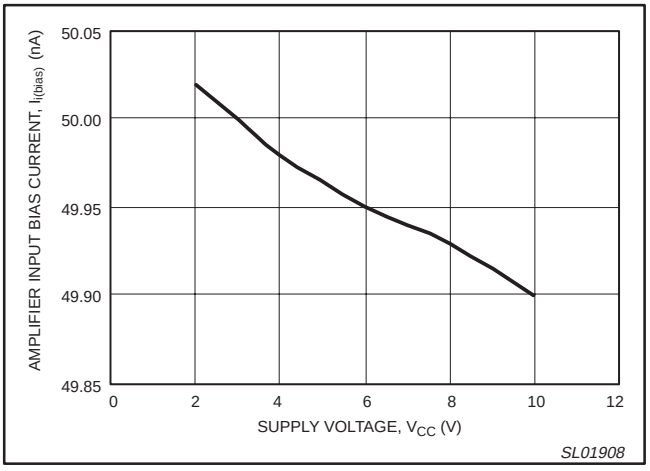


Figure 13. Amplifier input bias current versus supply voltage.

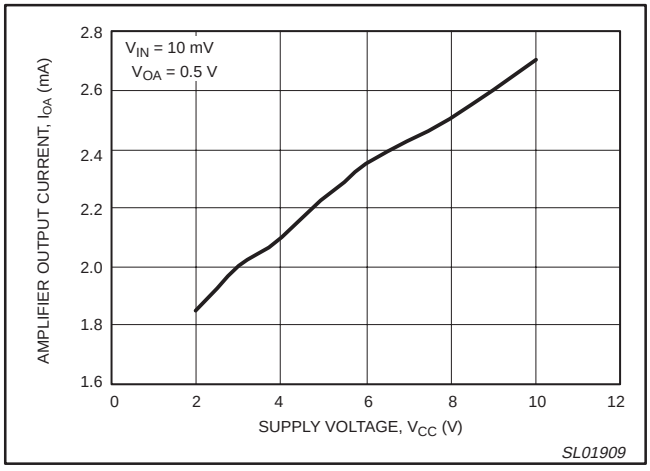


Figure 14. Amplifier output current versus supply voltage.

TYPICAL CHARACTERIZATION CURVES *(continued)*

Unless otherwise specified, V_{CC} = 3.0 V, V_{IN} = 0 V, and T_{amb} = 25 °C.

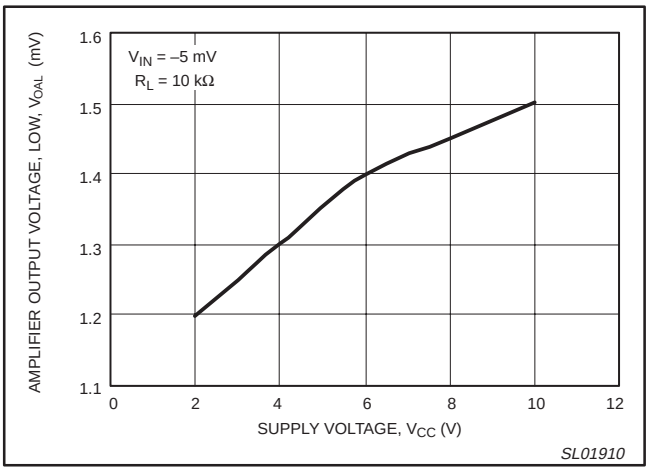


Figure 15. Amplifier output voltage, LOW versus supply voltage.

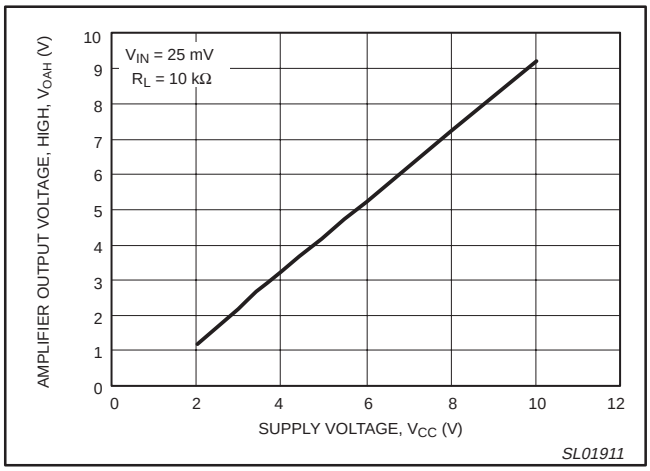


Figure 16. Amplifier output voltage, HIGH versus supply voltage.

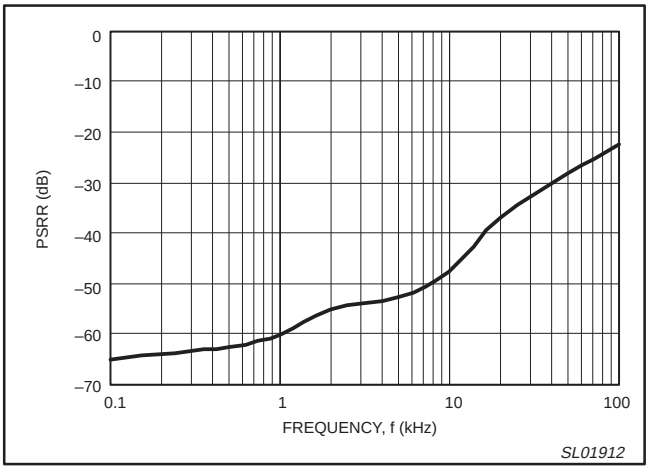


Figure 17. PSRR, power supply rejection ratio versus frequency.

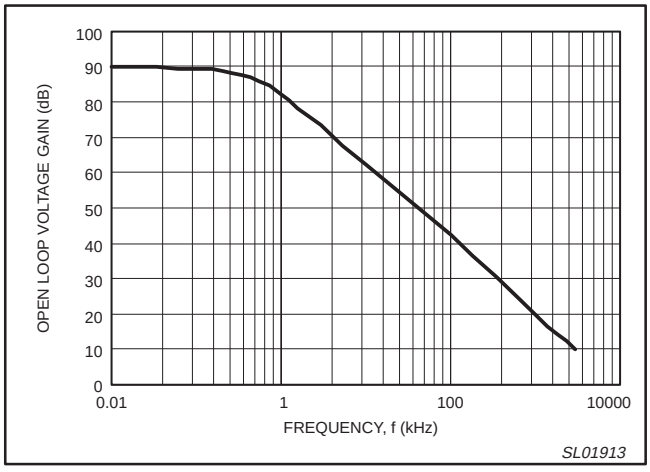


Figure 18. Open loop voltage gain versus frequency.

APPLICATION INFORMATION

The SA58602 is a precision dual op amps with PNP input stages and emitter follower outputs. It may be used as a sensor amplifier with a recommended gain from 20 to 50 dB. It also may be used as a dual comparator with V_{CC} "H" and ground "L" inputs. The output "L" is less than 10 mV and "H" is V_{CC} – 1 V.

It operates from 2 to 6 V single supply and each amplifier draws typically 100 μA making it attractive for battery operation. With very low input offset voltage (typically 100 mV), low input offset current (typically 1 nA) and low bias current (typically 50 nA), the SA58602 is ideal for error amplifiers, transducer buffer amplifiers, medical monitors, remote meters, signal conditioning and sensor amplifiers.

Determination of external components

Recommended amplifier gain is 40 dB. The gain is set by the combination of R1, R2, and R3 as shown in the following equations:

Av = (R3 + R2) / R3;

Av (dB) = 20 log (Av); and R3 = R1 II R2

For a gain of 40 dB, Av = 100 V/V, if R2 = 100 kΩ, then 99*R3 = 100 K; R3 = 1.01 kΩ.

R3 = R1*R2 / (R1 + R2); R3*R1 + R3*R2 = R1*R2: R3*R2 = R1 (R2 – R3)

Thus R1 = R3 * R2 / (R2 – R3) = 1.02 kΩ.

Comparator Circuit

As shown in Table 1 below, when the non-inverting input, IN+ is pulled "H" (to V_{CC}), and the inverting input, IN– is pulled "L" (to ground), then the output goes "H" (V_{CC} – 1 V). Conversely, if the non-inverting input is pulled "L", and the inverting input is pulled HIGH then the output goes "L".

Table 1. Logic table for Amp1 and Amp2

IN+	IN–	OUT	V_{OUT} level
H	L	H	V_{CC} – 1 V
L	H	L	10 mV
H	H	H	V_{CC} – 1 V
L	L	H	V_{CC} – 1 V

Application example

A gas burner flame detection circuit shown in Figure 19 consists of two amplifiers: AMP1 configured as an inverting amplifier and AMP2 configured as a comparator. If S1 selects V_{CC}, the inverting terminal of AMP2 is logic 1 (HIGH). When the flame is ON, the output of AMP1 is HIGH. Thus, the output of AMP2 is HIGH. Conversely, when the flame is OFF, AMP2 output is LOW.

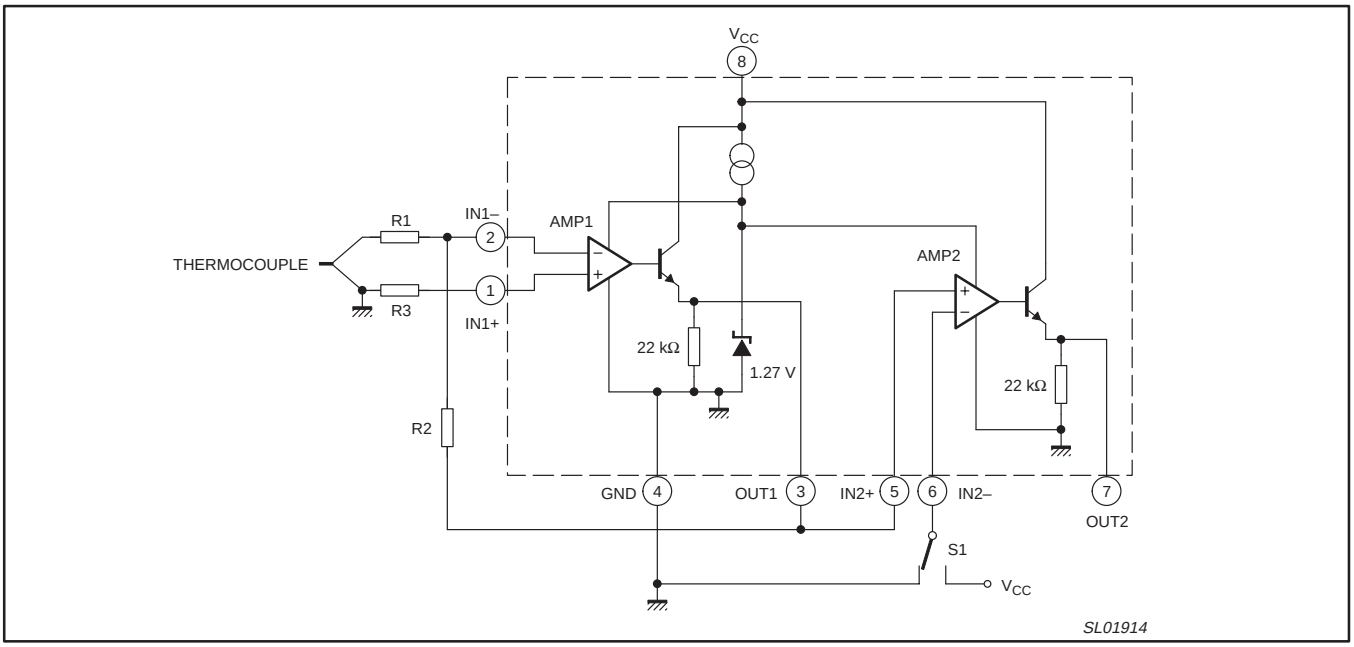


Figure 19. SA58602 gas burner flame detection circuit.

PACKING METHOD

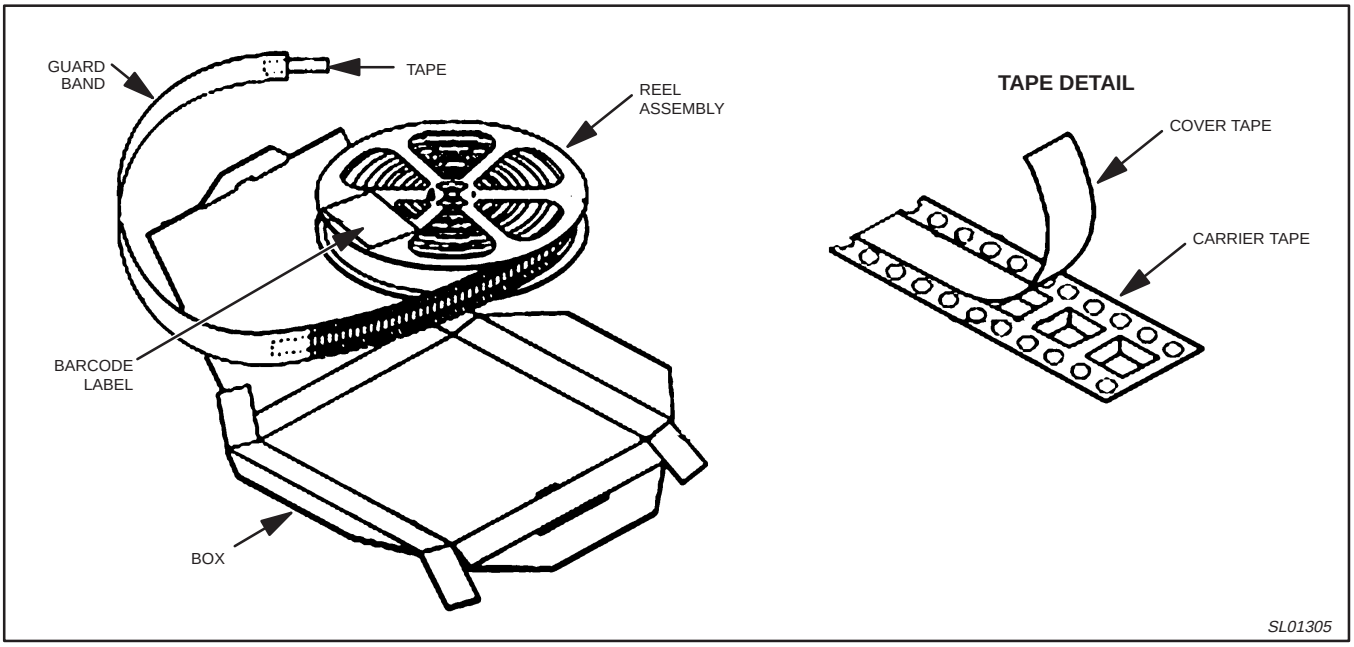
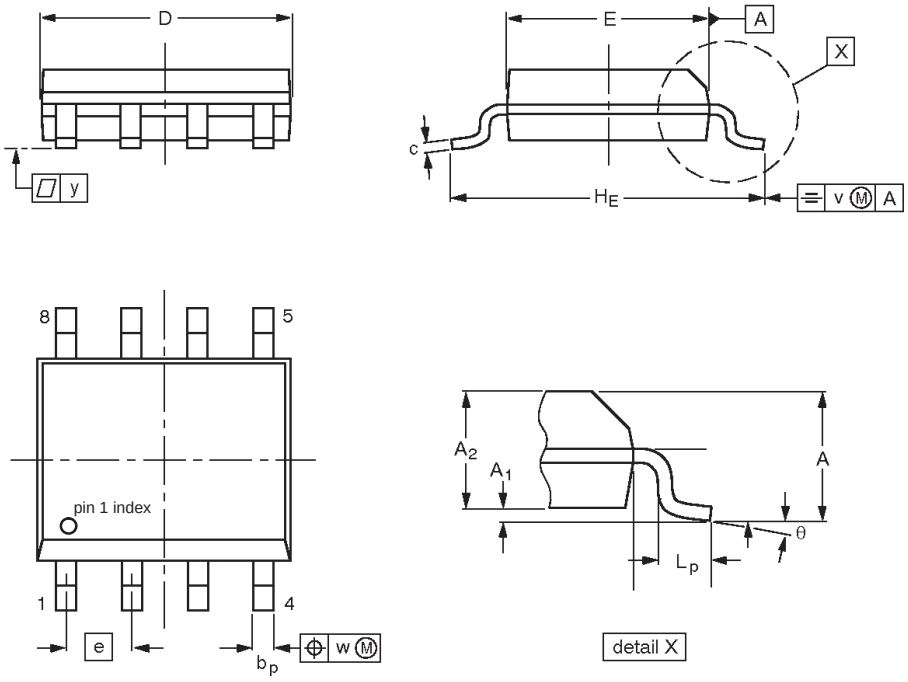
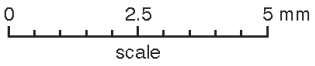


Figure 20. Tape and reel packing method.

SO8: plastic small outline package; 8 leads; body width 3.9 mm





DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	B_2	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E		L_p				y		θ
mm	1.73	0.25 0.10	1.45 1.25	4.95 4.80	0.51 0.33	0.25 0.19	4.95 4.80	4.0 3.8	1.27	6.2 5.8		1.27 0.38				0.076		8^o 0^o
inches	0.068	0.010 0.004	0.057 0.049	0.189 0.195	0.013 0.020	0.0100 0.0075	0.20 0.19	0.16 0.15	0.050	0.244 0.228		0.050 0.015				0.003		

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES			
	IEC	JEDEC	EIAJ	
SO8	076E03	MS-012		

REVISION HISTORY

Rev	Date	Description
_2	20021113	**Product data (9397 750 10648). Supersedes SA58602_1 of 2001 Oct 03 (9397 750 08954).** Engineering Change Notice 853–2288 29133 (date: 20021031). **Modifications:** ● Added “Typical characterization curves” and “Application information” sections.
_1	20011003	**Product data; initial version (9397 750 08954).** Engineering Change Notice 853–2288 27197 (date: 20011003).

Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definitions
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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