

# DATA SHEET

## **SA578**

Unity gain level programmable low power  
compandor

Product specification  
Replaces data of 1993 December 15  
IC17 Data Handbook

1997 Nov 07

**Philips Semiconductors**



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# Unity gain level programmable low power compandor

# SA578

## DESCRIPTION

The SA578 is a unity gain level programmable compandor designed for low power applications. The SA578 is internally configured as an expander and a compressor to minimize external component count.

The summing amplifiers of the SA578 have 600Ω drive capability and the inverting input of the compressor amplifier is accessible through Pin 9 for summing multiple external signals. Power Down/Mute function is active low and requires an open collector output logic configuration at Pin 8. If Power Down/Mute is not needed, Pin 8 should be left open. When the part is muted, supply current drops to 170mA at 3.6V.

## FEATURES

- Operating voltage range: 1.8V to 7V
- Low power consumption (1.4mA @ 3.6V)
- 0dB level programmable (10mV<sub>RMS</sub> to 1.0V<sub>RMS</sub>)
- Over 90dB of dynamic range
- Wide input/output swing capability
- Low external component count
- SA578 meets cellular radio specifications
- ESD hardened
- Power Down mode (I<sub>CC</sub> = 170μA @ 3.6V)
- Mute function
- Multiple external summing capability
- 600Ω drive capability

## PIN CONFIGURATION

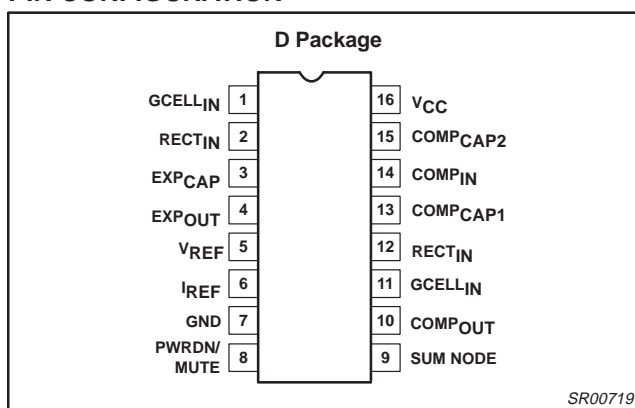


Figure 1. Pin Configuration

## APPLICATIONS

- High performance portable communications
- Cellular radio
- Cordless telephone
- Consumer audio
- Wireless microphones
- Modems
- Electric organs
- Hearing aids
- Automatic level control (ALC)

## ORDERING INFORMATION

| DESCRIPTION                       | TEMPERATURE RANGE | ORDER CODE | DWG #    |
|-----------------------------------|-------------------|------------|----------|
| 16-Pin Plastic Small Outline (SO) | -40 to +85°C      | SA578D     | SOT109-1 |

## ABSOLUTE MAXIMUM RATINGS

| SYMBOL           | PARAMETER                           | RATING      | UNITS |
|------------------|-------------------------------------|-------------|-------|
|                  |                                     | SA578       |       |
| V <sub>CC</sub>  | Supply voltage                      | 8           | V     |
| T <sub>A</sub>   | Operating ambient temperature range | -40 to +85  | °C    |
| T <sub>STG</sub> | Storage temperature range           | -65 to +150 | °C    |
| θ <sub>JA</sub>  | Thermal impedance SO                | 125         | °C/W  |

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## BLOCK DIAGRAM and TEST AND APPLICATION CIRCUIT

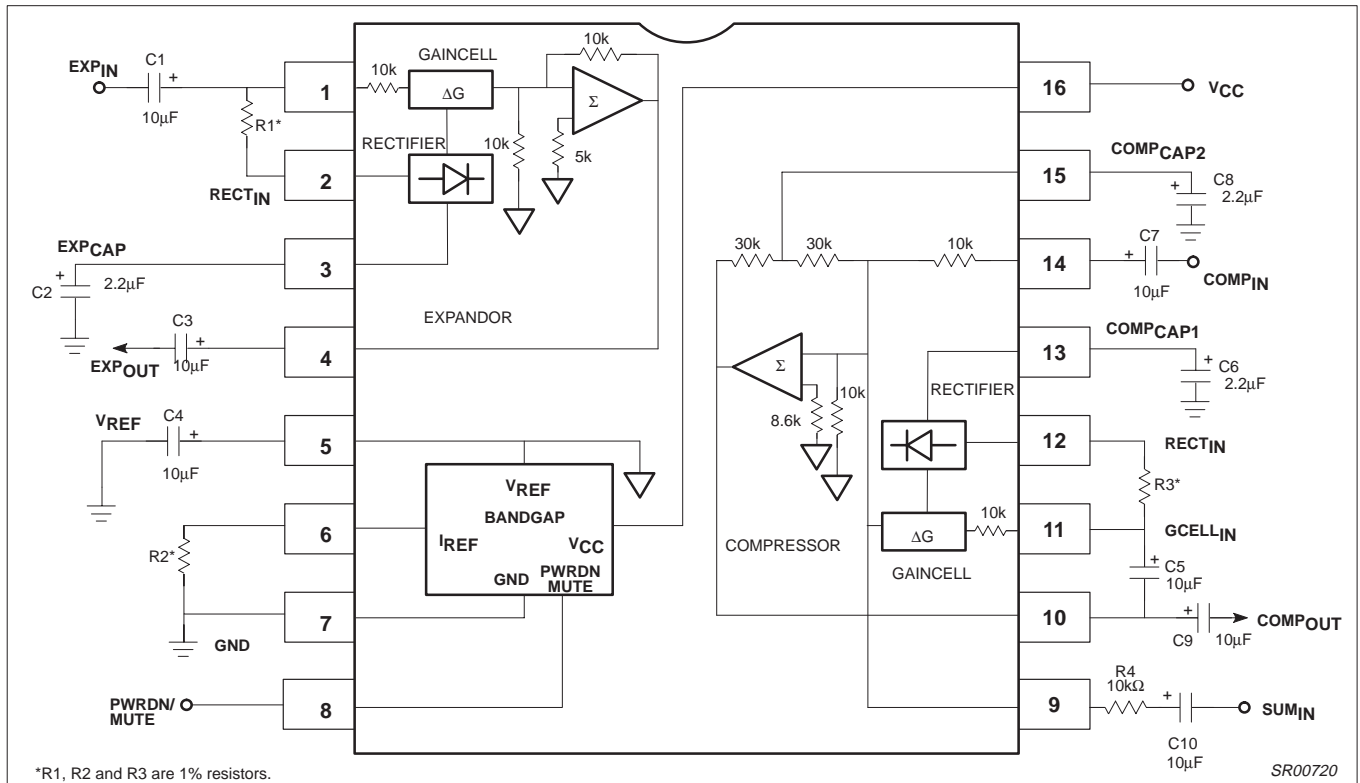


Figure 2. Block Diagram and Test and Application Circuit

## Unity gain level programmable low power compandor

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**ELECTRICAL CHARACTERISTICS**

$T_A = 25^\circ\text{C}$ ,  $V_{CC} = 3.6\text{VDC}$ , compandor 0dB level =  $-20\text{dBV} = 100\text{mV}_{\text{RMS}}$ , output load  $R_L = 10\text{k}\Omega$ , Freq = 1kHz, unless otherwise specified. R1, R2 and R3 are 1% resistors.

| SYMBOL    | PARAMETER                                 | TEST CONDITIONS   | LIMITS |                |     | UNITS               |
|-----------|---|---|--------|----------------|-----|---------------------|
|           |   |   | SA578  |                |     |                     |
|           |   |   | MIN    | TYP            | MAX |                     |
| $V_{CC}$  | Supply voltage <sup>1</sup>               |   | 2      | 3.6            | 7   | V                   |
| $I_{CC}$  | Supply current<br>operating<br>power down | No signal, $R_2 = 100\text{k}\Omega$                          |        | 1.4<br>170     | 2   | mA<br>$\mu\text{A}$ |
| $V_{REF}$ | Reference voltage <sup>2</sup>            | $V_{CC} = 3.6\text{V}$  | 1.7    | 1.8            | 1.9 | V                   |
| $R_L$     | Summing amp minimum output load           |   |        | 600            |     | $\Omega$            |
| THD       | Total harmonic distortion                 | 1kHz, 0dB, BW = 3.5kHz  |        | 0.25           | 1.0 | %                   |
| $E_{NO}$  | Expandor output noise voltage             | BW = 20kHz, $R_S = 0\Omega$                                   |        | 10             | 20  | $\mu\text{V}$       |
| 0dB       | Unity gain level                          | 0dB at 1kHz   | -1.0   | 0.18           | 1.0 | dB                  |
|           | Programmable range <sup>3</sup>           | $R_1 = R_3 = 18.7\text{k}\Omega$ , $R_2 = 24.3\text{k}\Omega$ |        | 0              |     | dBV                 |
|           |   | $R_1 = R_3 = 22.6\text{k}\Omega$ , $R_2 = 100\text{k}\Omega$  |        | -10            |     |                     |
|           |   | $R_1 = R_3 = 7.15\text{k}\Omega$ , $R_2 = 100\text{k}\Omega$  |        | -20            |     |                     |
|           |   | $R_1 = R_3 = 1.33\text{k}\Omega$ , $R_2 = 200\text{k}\Omega$  |        | -40            |     |                     |
| $V_{OS}$  | Output voltage offset                     | No signal   | -150   | 1              | 150 | mV                  |
|           | Expandor output DC shift                  | No signal to 0dB  | -100   | 7              | 100 | mV                  |
|           | Tracking error relative to 0dB output     | -20dB expandor  | -1.0   | 0.3            | 1.0 | dB                  |
|           | Crosstalk, COMP to EXP                    | 1kHz, 0dB, $C_{REF} = 10\mu\text{F}$                          |        | -80            | -65 | dB                  |
| $V_O$     | Output swing low                          |   |        | 0.2            |     | V                   |
|           | Output swing high                         |   |        | $V_{CC} - 0.2$ |     |                     |
|           | Power Down/Mute low level                 |   | 0      |                | 0.4 | V                   |
|           | Power Down/Mute input current             | Pin 8 grounded  |        | -65            |     | $\mu\text{A}$       |

**NOTE:**

1. Operation down to  $V_{CC} = 1.8\text{V}$  is possible.
2. Reference voltage,  $V_{REF}$ , is typically at  $1/2 V_{CC}$ .
3. Unity gain level can be adjusted CONTINUOUSLY between  $-40\text{dBV} = 10\text{mV}_{\text{RMS}}$  and  $0\text{dBV} = 1.0\text{V}_{\text{RMS}}$ . For details see application note AN1762.

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## TYPICAL PERFORMANCE CHARACTERISTICS

$V_{CC} = 3.6V$ ,  $T_A = 25^\circ C$ ,  $R_1=R_3=7.15k\Omega$ ,  $R_2=100k\Omega$ , 0dB level = 100mV, Freq. = 1kHz

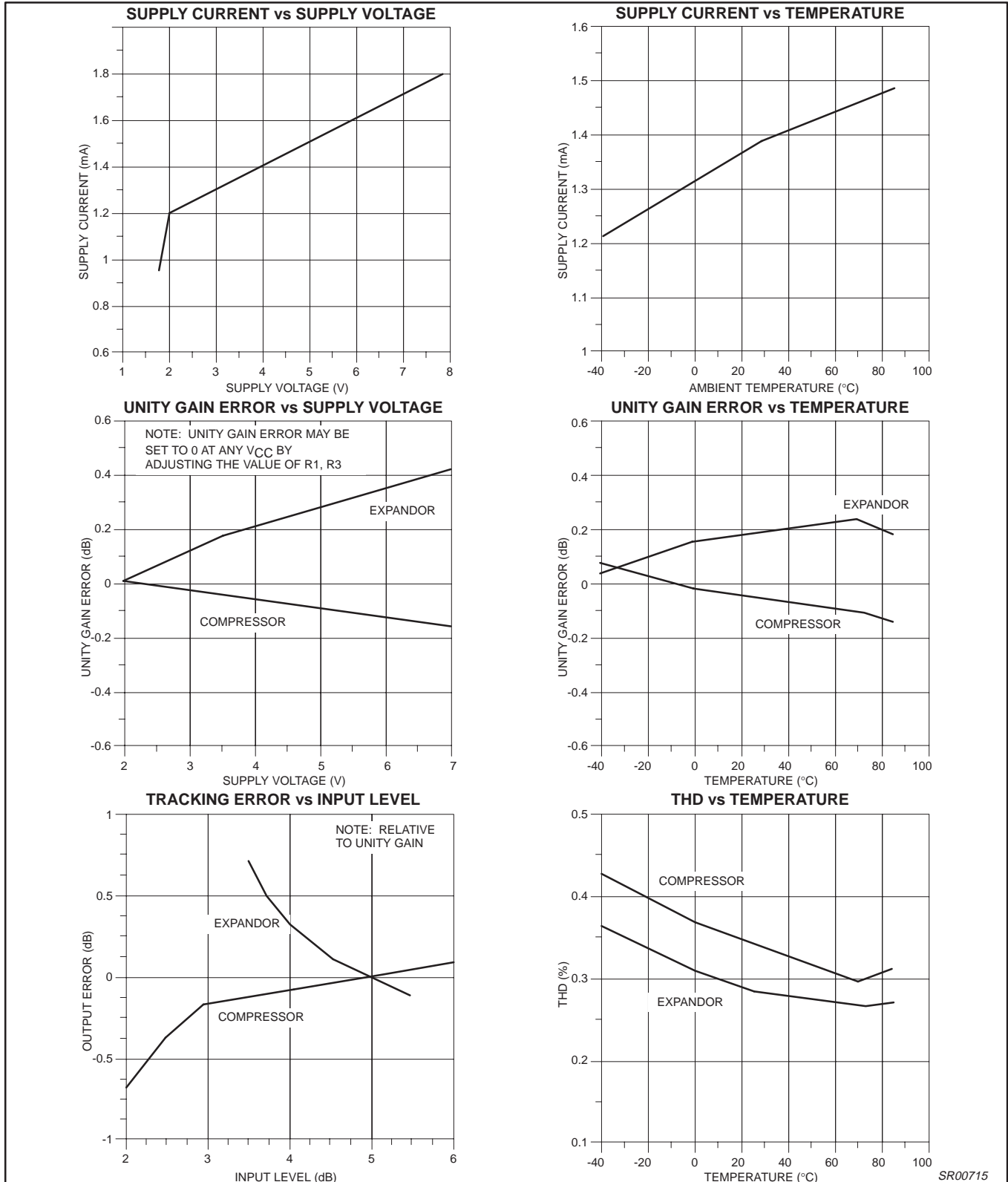


Figure 3. Typical Performance Characteristics

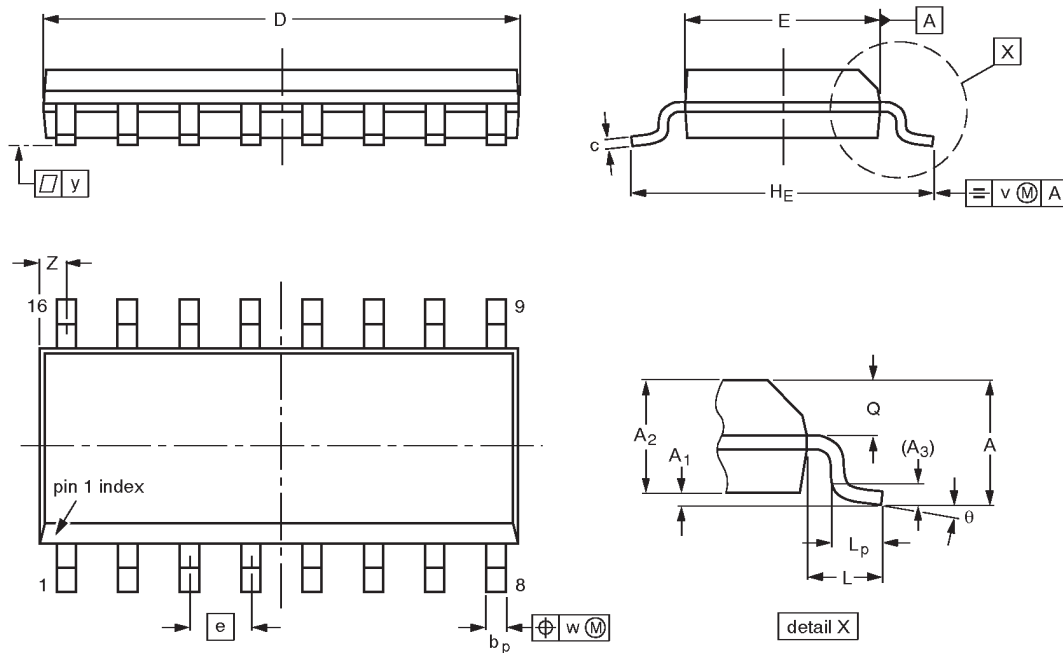
SR00715

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## SA578

**SO16: plastic small outline package; 16 leads; body width 3.9 mm**

**SOT109-1**



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

| UNIT   | A max. | A <sub>1</sub>   | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c                | D <sup>(1)</sup> | E <sup>(1)</sup> | e     | H <sub>E</sub> | L     | L <sub>p</sub> | Q              | v    | w    | y     | z <sup>(1)</sup> | θ        |
|--------|--------|------------------|----------------|----------------|----------------|------------------|------------------|------------------|-------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm     | 1.75   | 0.25<br>0.10     | 1.45<br>1.25   | 0.25           | 0.49<br>0.36   | 0.19<br>0.19     | 10.0<br>9.8      | 4.0<br>3.8       | 1.27  | 6.2<br>5.8     | 1.05  | 1.0<br>0.4     | 0.7<br>0.6     | 0.25 | 0.25 | 0.1   | 0.7<br>0.3       | 8°<br>0° |
| inches | 0.069  | 0.0098<br>0.0039 | 0.057<br>0.049 | 0.01           | 0.019<br>0.014 | 0.0098<br>0.0075 | 0.39<br>0.38     | 0.16<br>0.15     | 0.050 | 0.24<br>0.23   | 0.041 | 0.039<br>0.016 | 0.028<br>0.020 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012   |          |

**Note**

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

| OUTLINE VERSION | REFERENCES |          |      |  | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|----------|------|--|---------------------|----------------------|
|                 | IEC        | JEDEC    | EIAJ |  |                     |                      |
| SOT109-1        | 076E07S    | MS-012AC |      |  |                     | 91-08-13<br>95-01-23 |

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## DEFINITIONS

| Data Sheet Identification        | Product Status                | Definition   |
|----------------------------------|-------------------------------|--|
| <i>Objective Specification</i>   | <b>Formative or in Design</b> | This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.   |
| <i>Preliminary Specification</i> | <b>Preproduction Product</b>  | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |
| <i>Product Specification</i>     | <b>Full Production</b>        | This data sheet contains Final Specifications. Philips Semiconductors reserves the right to make changes at any time without notice, in order to improve design and supply the best possible product.  |

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