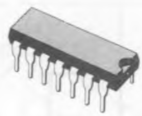
**SGS-THOMSON MICROELECTRONICS**

# LS285

## TELEPHONE SPEECH CIRCUITS

- 2/4 WIRE INTERFACE
- OPERATES DOWN TO 4 mA
- 3.5 $V_{pp}$ DYNAMIC IN SENDING AT 25 mA



**DIP14**
(Plastic)

**ORDER CODE** : LS285AB1

### DESCRIPTION

The LS285 is monolithic integrated circuits for replacement of the hybrid circuit (2-4 wire interface) in conventional telephones interfacing the two transducers to the line and providing a controlled amount of sidetone.

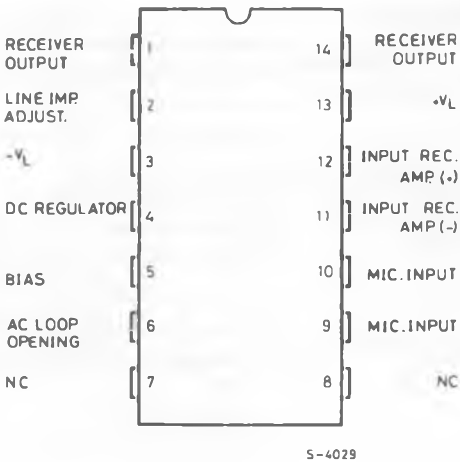
The same type of transducer can be used for both transmitter and receiver, usually a 350 Ω dynamic type.

By sensing the line current, LS285 adjusts the gain in both directions to compensate for line attenuation.

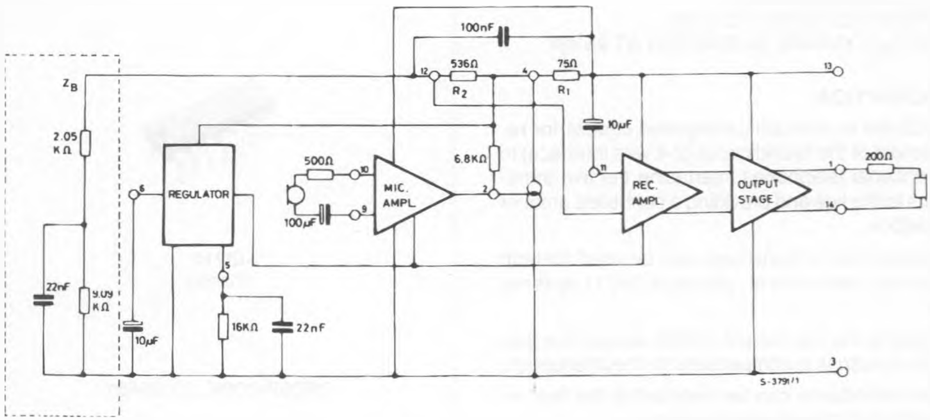
Output impedance can be matched to the line, independent of transducer impedance.

The LS285 is packaged in a 14 lead dual in–line plastic package.

### PIN CONNECTION (top view)



## BLOCK DIAGRAM




## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_L$ | Line Voltage (3 ms pulse duration) | 22 | V |
| $I_L$ | Forward Current | 120 | mA |
| $I_L$ | Reverse Current | – 150 | mA |
| $P_{tot}$ | Total Power Dissipation at $T_{amb}$ = 70 °C | 1 | W |
| $T_{stg}$ | Storage and Junction Temperature | – 55 to 150 | °C |
| $T_{op}$ | Operating Temperature | – 40 to 70 | °C |

## THERMAL DATA

| | | | |
|---|---|---|---|
| $R_{th\ j\text{-}amb}$ | Thermal Resistance Junction-ambient Max | 80 | °C/W |

## DESCRIPTION

The LS285 is based on a bridge configuration.

They contain a regulator block, a sending amplifier and a receiver amplifier.

The regulator monitors the line current and adjusts the amplifier gain to compensate for the line length. It provides DC characteristics in line with CEPT standards.

The transmit/receiver amplifiers are connected to the line via an external bridge to provide sidetone attenuation.

The line current compensation ensures that when the subscriber is talking, the signal delivered to the line is increased in according to the line lenght. When he is hearing, the signal level on the receiver capsule is constant.

The amplifiers can also be matched to different transducers simply by varying external components. Gain variation over the operating temperature range is less than ± 1 dB.

The impedance to the line can be adjusted ; without any change in circuit parameters ; by changing an external resistor (6.8 KΩ at pin 2).

## BASIC CIRCUIT CONFIGURATION.

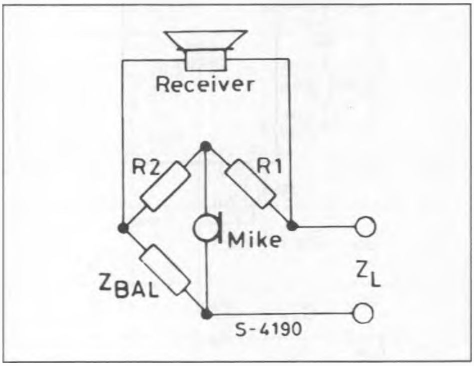



**Figure 1 :** Test Circuit.

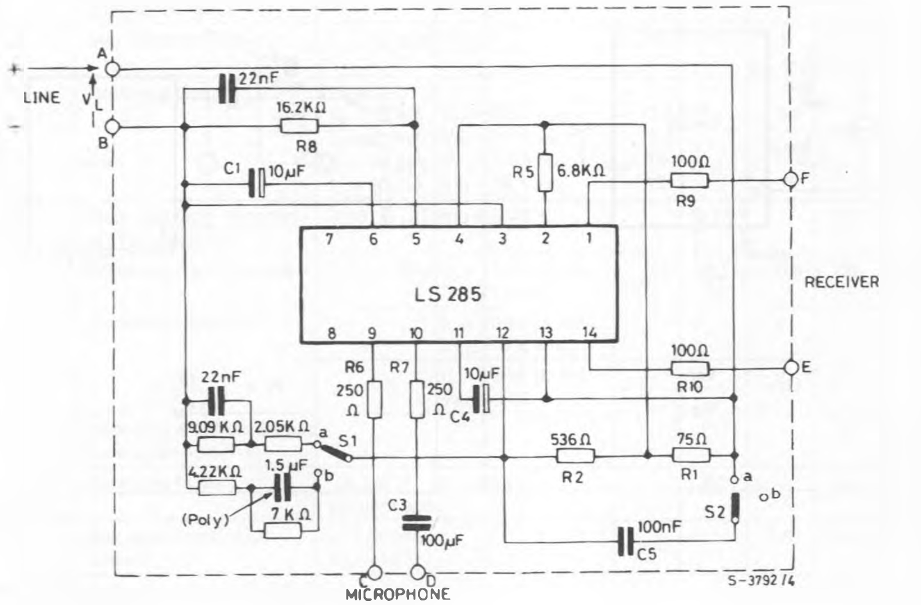
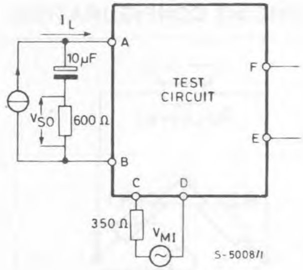
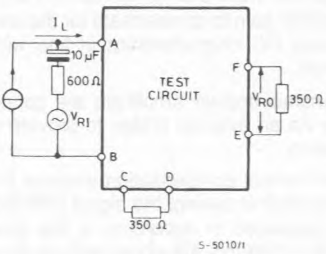


**Figure 2 :** Sending Gain.



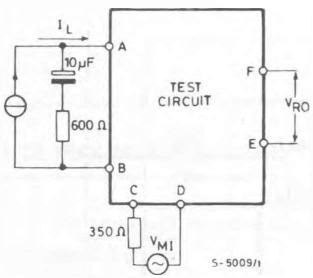

$$G_S = \frac{V_{SO}}{V_{MI}}$$

**Figure 3 :** Receiving Gain.



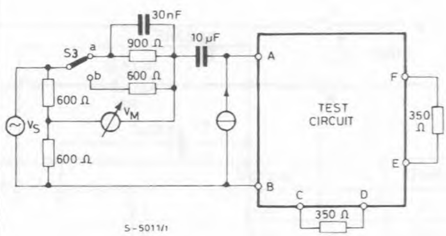

$$G_R = \frac{V_{RO}}{V_{RI}}$$

**Figure 4 :** Sidetone.




$$G_S = \frac{V_{RO}}{V_{MI}}$$

**Figure 5 :** Return Loss.




$$R_L = \frac{V_S}{2\,V_M}$$

**ELECTRICAL CHARACTERISTIC** (refer to the test circuit, $T_{amb}$ = 25 °C, f = 300 Hz to 3400 Hz, S1, S2 in "a" unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit | Fig. |
|---|---|---|---|---|---|---|---|
| $V_L$ | Line Voltage | – 15 °C < $T_{amb}$ < + 45 °C<br>$I_L$ = 80 mA<br>$I_L$ = 20 mA<br>$I_L$ = 10 mA | <br>9.5<br>4.8<br>3.6 | | <br>11.5<br>5.8<br>1.6 | V | 1 |
| $G_s$ | Sending Gain | f = 1 KHz<br>$I_L$ = 15 mA ; $V_{MI}$ = 1.0 $V_{RMS}$<br>$I_L$ = 30 mA ; $V_{MI}$ = 2.5 $V_{RMS}$<br>$I_L$ = 60 mA ; $V_{MI}$ = 3.7 $V_{RMS}$<br>$I_L$ = 80 mA ; $V_{MI}$ = 4.5 $V_{RMS}$ | <br>48.5<br>47.4<br>42.7<br>42.0 | | <br>52.5<br>51.5<br>46.1<br>45.3 | dB | 2 |
| $G_s$ | Sending Gain Variation vs. Temp. | – 15 °C < $T_{amb}$ < + 45 °C | | 0.8 | | dB | 2 |
| | Sending Gain Flatness | $I_L$ = 10 to 80 mA<br>$f_{ref}$ = 1 KHz<br>S1, S2 in (b) | | - 0.5 | + 0.5 | dB | 2 |
| | Sending Distortion | $I_L$ = 10 to 15 mA ;<br>$V_{so}$ = 0.7 $V_p$ | | | 2 | % | 2 |
| | | $I_L$ = 16 to 24 mA ;<br>$V_{so}$ = 1.3 $V_p$ | | | 2 | % | |
| | | $I_L$ = 25 to 80 mA ;<br>$V_{so}$ = 1.7 $V_p$ | | | 10 | % | |
| | Sending Noise | $V_{MI}$ = 0 V $I_L$ = 60 mA | | – 73 | | dBmp | 2 |
| | Microphone Amplifier Impedance (pin 9-10) | | | 95 | | Ω | 1 |
| | Max Sending Output (°) | $I_L$ = 10 to 80 mA<br>$V_{MI}$ = 1 V | | | 3 | $V_p$ | 2 |
| $G_R$ | Receiving Gain | f = 1 KHz<br>$I_L$ = 15 mA ; $V_{RI}$ = 0.8 $V_{RMS}$<br>$I_L$ = 30 mA ; $V_{RI}$ = 1.0 $V_{RMS}$<br>$I_L$ = 60 mA ; $V_{RI}$ = 1.8 $V_{RMS}$<br>$I_L$ = 80 mA ; $V_{RI}$ = 10 $V_{RMS}$ | <br>– 13.3<br>– 13.5<br>– 18<br>– 19 | | <br>– 9.6<br>– 10.5<br>– 14.9<br>– 16 | dB | 3 |
| $\Delta G_R$ | Receiving Gain Variation vs. Temperature | – 15 °C < Tamb < + 45 °C | | 0.25 | | dB | 3 |
| | Receiving Gain Flatness | $f_{ref}$ = 1 KHz $I_L$ = 10 to 80 mA<br>S1, S2 in (b) | – 0.5 | | + 0.5 | dB | 3 |
| | Receiving Distortion | $I_L$ = 10 to 15 mA<br>$V_{RO}$ = 300 $mV_p$ | | | 2 | % | 3 |
| | | $I_L$ = 15 to 80 mA<br>$V_{RO}$ = 500 $mV_p$ | | | 2 | | |
| | Receiving Amplifier Output Impedance (pin 1-4) | | | 110 | | Ω | 1 |
| | Receiving Noise | $V_{RI}$ = 0 V $I_L$ = 60 mA<br>psophometric | | 80 | | µV | 3 |
| | Max receiving Output Current | $I_L$ = 80 mA<br>$V_{RI}$ = 10 V | | | 3.6 | mAp | 3 |

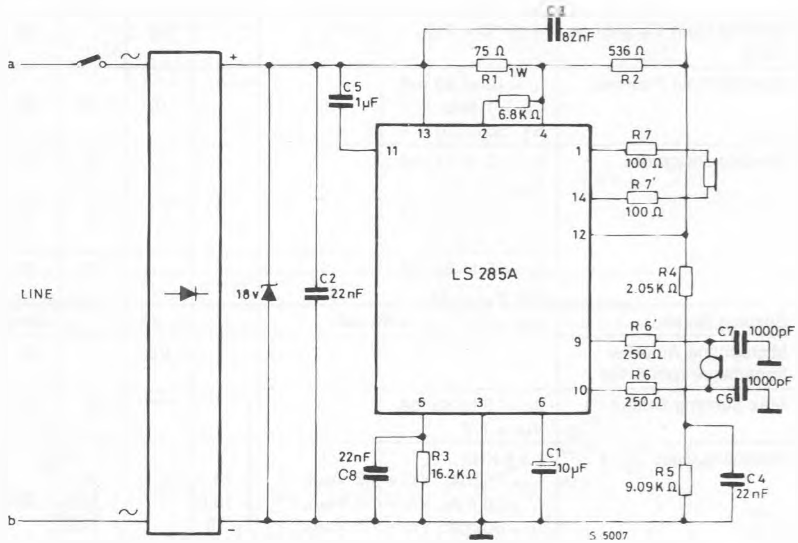
(*) This output is limited to allow for input overvoltages.

## ELECTRICAL CHARACTERISTIC (continued)

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit | Fig. |
|---|---|---|---|---|---|---|---|---|
| | Sidetone | f = 1 KHz | $I_L$ = 20 mA | | 7 | | dB | 4 |
| | | | $I_L$ = 80 mA | | 0 | | dB | |
| | Return Loss | S3 in (a) | | | 14 | | dB | 5 |
| | | S3 in (b) | | | 14 | | dB | |

(*) This output is limited to allow for input overvoltages.

**Figure 6 :** Typical Application Circuit.



## APPLICATION INFORMATION

The following table shows the recommended values for the typical application circuit of fig. 6. Different values can be used and notes are added in order to help designer.

| Component | Recommended Value | Purpose | Note |
|---|---|---|---|
| R1 | 75 Ω | Bridge Resistors | The ratio R2/R1 fixes the amount of the signal delivered to the line. (see fig. 7) |
| R2 | 536 Ω | | |
| R3 | 16.2 KΩ | Bias Resistor | Changing R3 value it is possible to shift the gain characteristics. The value can be chosen from 15 KΩ to 20 KΩ. The recommended value assures the maximum swing (see fig. 9). |
| R4 | 2.05 KΩ | Balance Network | In order to optimize the sidetone it is possible to change R4 and R5 values. In any case : $\frac{Z_B}{Z_L} = \frac{R2}{R1}$ where $Z_B$ = R4 + R5//C4. |
| R 5 | 9.09 KΩ | | |
| R6 and R6' | 250 Ω | Microphone Impedance Matching | R6 and R6' must be equal ; 250 Ω is a typical value for dynamic capsules. Furthermore, they determine a sending gain variation according to : $\Delta G_s = 20 \log \frac{Rx}{850\ \Omega}$ where Rx = R6 + R6' + $R_{mike}$. The trend of $\Delta G_s$ as a function of Rx value is shown in fig. 8. |
| R7 and R7' | 100 Ω | Receive Impedance Matching | R7 and R7' must be equal ; 100 Ω is a typical value for dynamic capsules. |
| C1 | 10 µF | AC Loop Opening | Ensures a high regulator impedance for AC signals (≈ 20 KΩ). This capacitor should not be higher than 10 µF in order to have a short response time of the system. |
| C2 | 22 nF | Matching to a Capacitive Line | C2 changes with the characteristics of the transmission line. |
| C3 | 82 nF | High Frequency Roll-off | C3 determines the high frequency response of the circuit. it also acts as RF bypass. |
| C4 | 22 nF | Balance Network | See Note for R4 and R5. |
| C5 | 1 µF | DC decoupling for Receiving Input | |
| C6 and C7 | 1000 pF | RF Bypass | |
| C8 | 22 nF | Filter Capacitor | |

**Figure 7 :** Receiving Gain Variation vs. R1 Value (with fixed R1/R2 ratio).

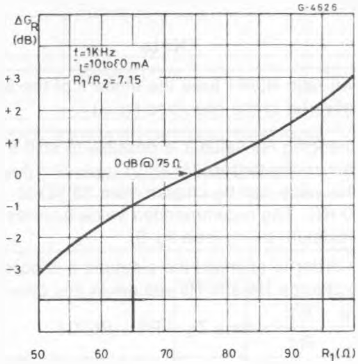



**Figure 8 :** Sending Gain Variation vs. Rx Value (see note for R6 and R6').

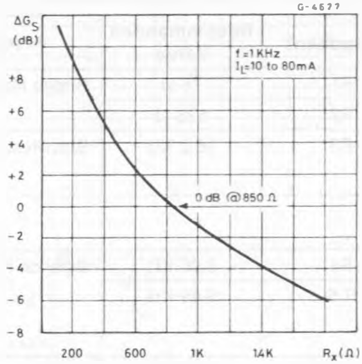



**Figure 9 :** Sending and receiving Gain Variation vs. Line Current.