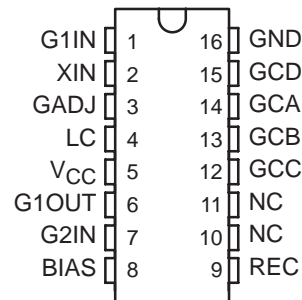


- **Designed for Use With the TL851 in Sonar Ranging Modules Like the SN28827**
- **Digitally Controlled Variable-Gain Variable-Bandwidth Amplifier**
- **Operational Frequency Range of 20 kHz to 90 kHz**
- **TTL-Compatible**
- **Operates From Power Sources of 4.5 V to 6.8 V**
- **Interfaces to Electrostatic or Piezoelectric Transducers**
- **Overall Gain Adjustable With One External Resistor**

**N PACKAGE  
(TOP VIEW)**



NC – No internal connection

## description

The TL852 is an economical sonar ranging receiver integrated circuit for use with the TL851 control integrated circuit. A minimum of external components is required for operation, and this amplifier easily interfaces to Polaroid's 50-kHz electrostatic transducer. An external 68-k $\Omega$   $\pm$ 5% resistor from BIAS to GND provides the internal biasing reference. Amplifier gain can be set with a resistor from G1IN to GADJ. Required amplifier gain will vary for different applications. Using the detect-level measurement circuit of Figure 1, a nominal peak-to-peak value of 230 mV input during gain step 2 is recommended for most applications. For reliable operation, a level no lower than 50 mV should be used. The recommended detect level of 230 mV can be obtained for most amplifiers with an R1 value between 5 k $\Omega$  and 20 k $\Omega$ .

Digital control of amplifier gain is provided with gain control inputs GCA, GCB, GCC, and GCD. These inputs must be driven synchronously (all inputs stable within 0.1  $\mu$ s) to avoid false receive output signals due to invalid logic counts. This can be done easily with the TL851 control integrated circuit. A plot showing relative gain for the various gain steps versus time can be seen in Figure 2. To dampen ringing of the 50-kHz electrostatic transducer, a 5-k $\Omega$  resistor from G1IN to XIN is recommended.

An external parallel combination of inductance and capacitance between LC and VCC provides an amplifier with an externally controlled gain and Q. This not only allows control of gain to compensate for attenuation of signal with distance, but also maximizes noise and sidelobe rejection. Care must be taken to accurately tune the L-C combination at operating frequency or gain and Q will be greatly reduced at higher gain steps.

AC coupling between stages of the amplifier is accomplished with a 0.01-mF capacitor for proper biasing.

The receive output is normally held at a low level by an internal 1- $\mu$ A current source. When an input of sufficient amplitude is received, the output is driven alternately by the 1- $\mu$ A discharge current and a 50- $\mu$ A charging current. A 1000-pF capacitor is required from REC to GND to integrate the received signal so that one or two noise pulses will not be recognized.

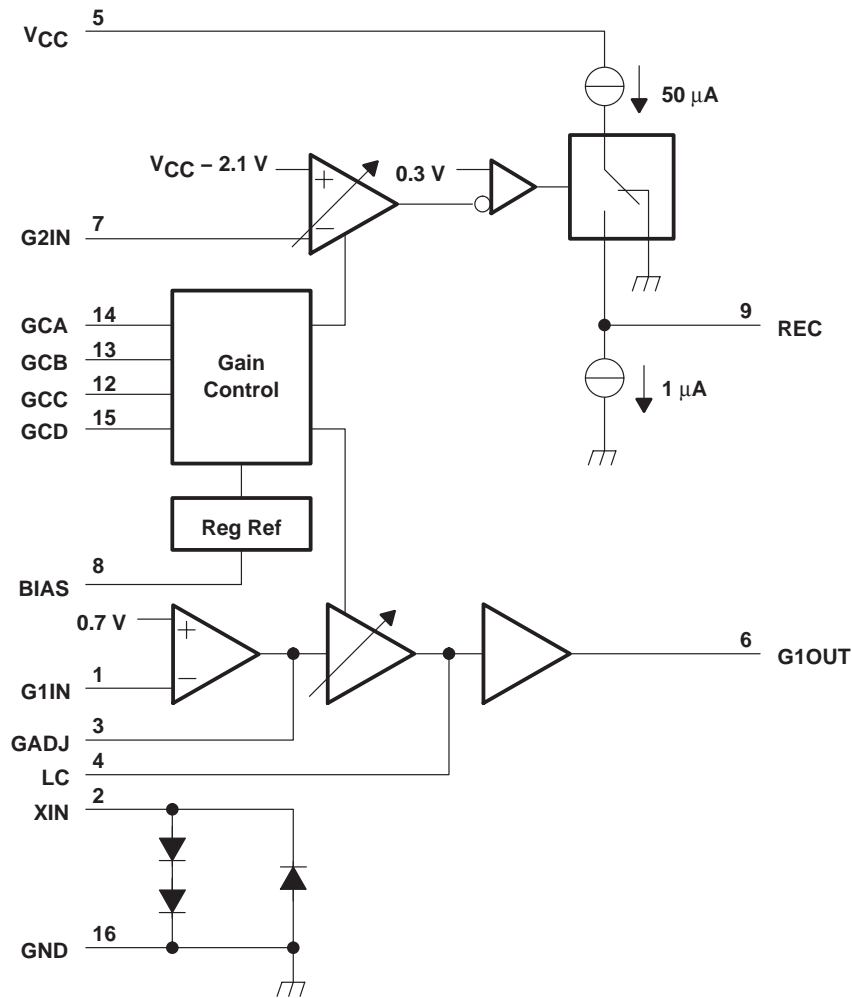
XIN provides clamping for the transformer secondary when used for transducer transmit drive as shown in Figure 4 of the SN28827 data sheet.

The TL852 is characterized for operation from 0°C to 40°C.

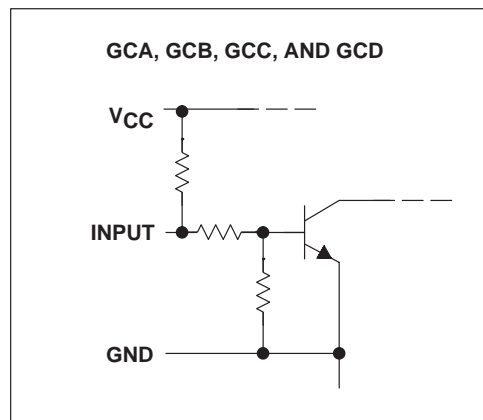
# TL852 SONAR RANGING RECEIVER

SLSS003 – SEPTEMBER 1983 – REVISED MARCH 1988

## functional block diagram



## schematic of gain control inputs



**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†**

|   |                 |
|---|-----------------|
| Voltage at any pin with respect to GND .....  | – 0.5 V to 7 V  |
| Voltage at any pin with respect to $V_{CC}$ .....                                       | – 7 V to 0.5 V  |
| XIN input current (50% duty cycle) .....  | $\pm 60$ mA     |
| Continuous power dissipation at (or below) 25°C free-air temperature (see Note 1) ..... | 1150 mW         |
| Operating free-air temperature range .....  | – 40°C to 85°C  |
| Storage temperature range .....   | – 65°C to 150°C |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds .....                      | 260°C           |

† Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. This is a stress rating only, and functional operation of the device at these or any other conditions beyond those indicated in the recommended operating conditions section of this specification is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: For operation above 25°C, derate linearly at the rate of 9.2 mW/°C.

**recommended operating conditions**

|                                       | MIN | MAX | UNIT       |
|---------------------------------------|-----|-----|------------|
| Supply voltage, $V_{CC}$              | 4.5 | 6.8 | V          |
| High-level input voltage, $V_{IH}$    | 2.1 |     | V          |
| Low-level input voltage, $V_{IL}$     | 0.6 |     |            |
| Bias resistor between BIAS and GND    | 64  | 72  | k $\Omega$ |
| Operating free-air temperature, $T_A$ | 0   | 40  | °C         |

**electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)**

| PARAMETER  | TEST CONDITIONS                          | MIN | TYP‡  | MAX | UNIT    |
|--|--|-----|-------|-----|---------|
| Input clamp voltage at XIN                                   | $I_I = 40$ mA                            |     | 2.5   |     | V       |
|  | $I_I = -40$ mA                           |     | – 1.5 |     |         |
| Open-circuit input voltage at GCA, GCB, GCC, GCD             | $V_{CC} = 5$ V, $I_I = 0$                |     | 2.5   |     | V       |
| High-level input current, $I_{IH}$ , into GCA, GCB, GCC, GCD | $V_{CC} = 5$ V, $V_{IH} = 2$ V           |     | – 0.5 |     | mA      |
| Low-level input current, $I_{IL}$ , into GCA, GCB, GCC, GCD  | $V_{CC} = 5$ V, $V_{IL} = 0$             |     |       | – 3 | mA      |
| Receive output current                                       | $I_{G2IN} = -100$ $\mu$ A, $V_O = 0.3$ V |     | 1     |     | $\mu$ A |
|  | $I_{G2IN} = 100$ $\mu$ A, $V_O = 0.1$ V  |     | – 50  |     |         |
| Supply current, $I_{CC}$                                     |  |     |       | 45  | mA      |

‡ Typical values are at  $V_{CC} = 5$  V and  $T_A = 25^\circ\text{C}$ .



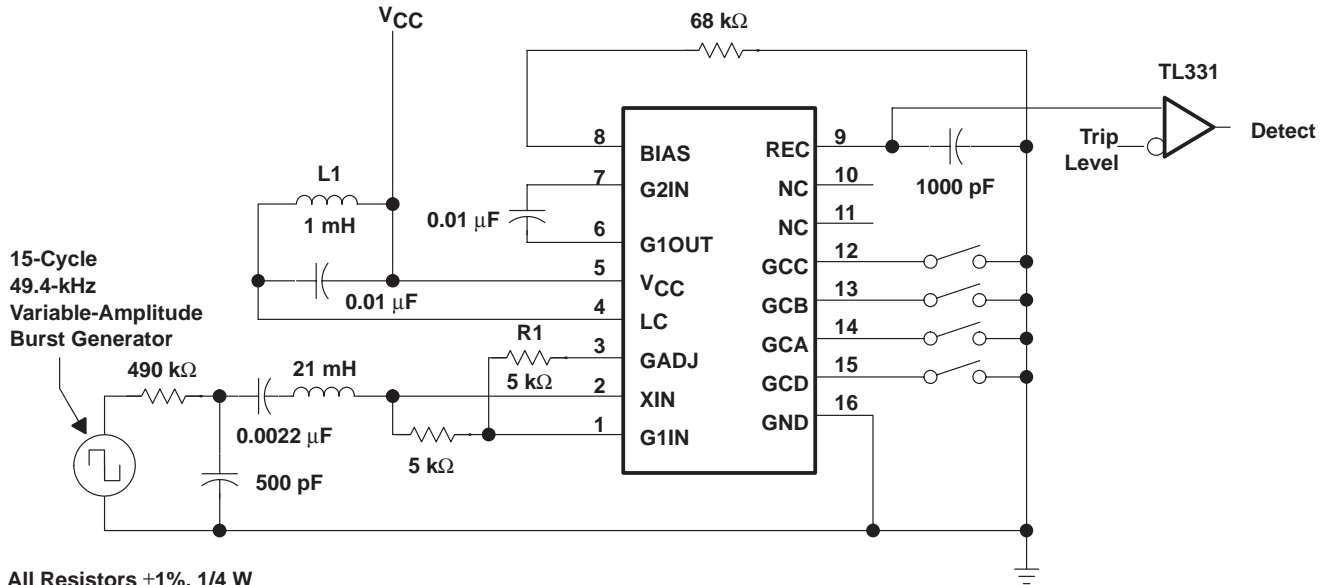
# TL852 SONAR RANGING RECEIVER

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## APPLICATION INFORMATION

### detect level versus gain step

Detect level is measured by applying a 15-cycle burst of 49.4 kHz square wave just after the beginning of the gain step to be tested. The least burst amplitude that makes REC reach the trip level is defined to be the detect level. System gain is then inversely proportional to detect level. See the test circuit in Figure 1.



All Resistors  $\pm 1\%$ , 1/4 W  
 All Capacitors  $\pm 1\%$ , Film  
 L1 Q > 60 at 50 kHz  
 C1 Q > 500 at 50 kHz

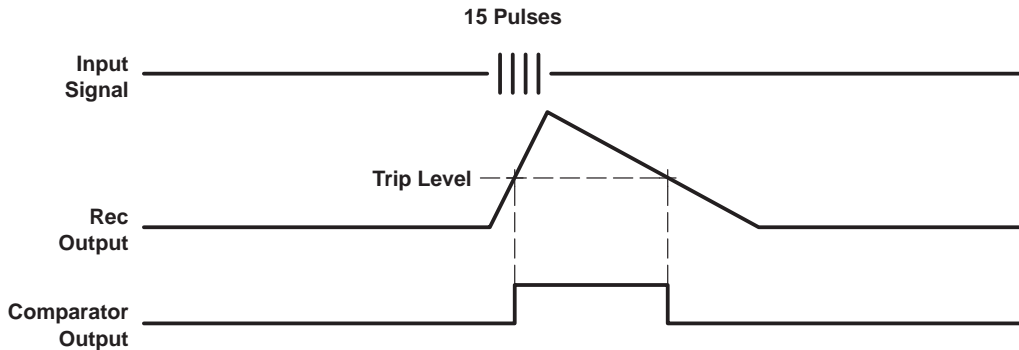


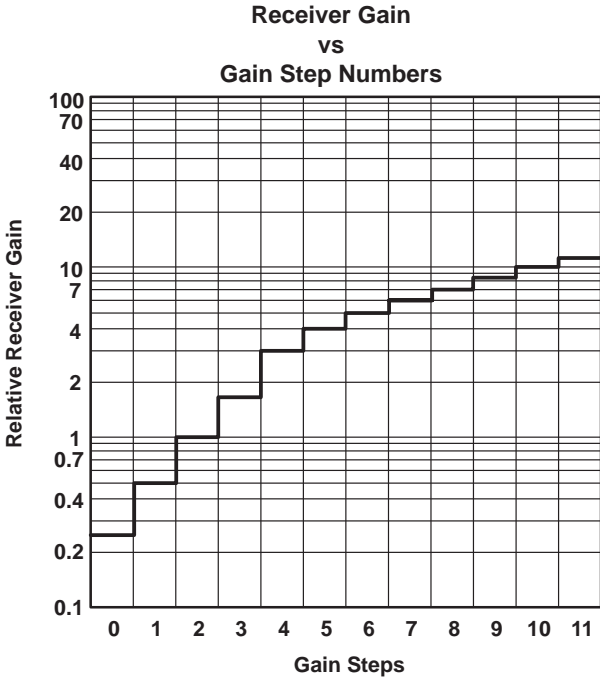
Figure 1. Detect-Level Measurement Circuit and Waveforms



**APPLICATION INFORMATION**

**GAIN STEP TABLE**

| GCD | GCC | GCB | GCA | STEP NUMBER |
|-----|-----|-----|-----|-------------|
| L   | L   | L   | L   | 0           |
| L   | L   | L   | H   | 1           |
| L   | L   | H   | L   | 2           |
| L   | L   | H   | H   | 3           |
| L   | H   | L   | L   | 4           |
| L   | H   | L   | H   | 5           |
| L   | H   | H   | L   | 6           |
| L   | H   | H   | H   | 7           |
| H   | L   | L   | L   | 8           |
| H   | L   | L   | H   | 9           |
| H   | L   | H   | L   | 10          |
| H   | L   | H   | H   | 11          |



**Figure 2**



**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| TL852CDR         | ACTIVE        | SOIC         | D               | 16   | 2500        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   |              | TL852C                  | <a href="#">Samples</a> |
| TL852CN          | ACTIVE        | PDIP         | N               | 16   | 25          | RoHS & Green    | NIPDAU                               | N / A for Pkg Type   |              | TL852CN                 | <a href="#">Samples</a> |
| TL852CN          | ACTIVE        | PDIP         | N               | 16   | 25          | RoHS & Green    | NIPDAU                               | N / A for Pkg Type   |              | TL852CN                 | <a href="#">Samples</a> |
| TL852CNE4        | ACTIVE        | PDIP         | N               | 16   | 25          | RoHS & Green    | NIPDAU                               | N / A for Pkg Type   |              | TL852CN                 | <a href="#">Samples</a> |
| TL852CNE4        | ACTIVE        | PDIP         | N               | 16   | 25          | RoHS & Green    | NIPDAU                               | N / A for Pkg Type   |              | TL852CN                 | <a href="#">Samples</a> |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

| Device   | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|----------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TL852CDR | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |



**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

| Device   | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------|--------------|-----------------|------|------|-------------|------------|-------------|
| TL852CDR | SOIC         | D               | 16   | 2500 | 350.0       | 350.0      | 43.0        |

**TUBE**


\*All dimensions are nominal

| Device    | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-----------|--------------|--------------|------|-----|--------|--------|--------|--------|
| TL852CN   | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL852CNE4 | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  -  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

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