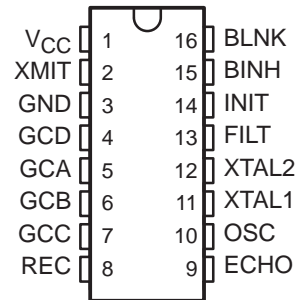


- Designed for Use With the TL852 in Sonar Ranging Modules Like the SN28827
- Operates With Single Supply
- Accurate Clock Output for External Use
- Synchronous 4-Bit Gain Control Output
- Internal 1.2-V Level Detector for Receive
- TTL-Compatible
- Interfaces to Electrostatic or Piezoelectric Transducers

N PACKAGE  
(TOP VIEW)



## description

The TL851 is an economical digital I<sup>2</sup>L ranging control integrated circuit designed for use with the Texas Instruments TL852 sonar ranging receiver integrated circuit.

The TL851 is designed for distance measurement from six inches to 35 feet. The device has an internal oscillator that uses a low-cost external ceramic resonator. With a simple interface and a 420-kHz ceramic resonator, the device will drive a 50-kHz electrostatic transducer.

The device cycle begins when Initiate (INIT) is taken to the high logic level. There must be at least 5 ms from initial power-up (V<sub>CC</sub>) to the first initiate signal in order for all the device internal latches to reset and for the ceramic-resonator-controlled oscillator to stabilize. The device will transmit a burst of 16 pulses each time INIT is taken high.

The oscillator output (OSC) is enabled by INIT. The oscillator frequency is the ceramic resonator frequency divided by 8.5 for the first 16 cycles (during transmit) and then the oscillator frequency changes to the ceramic resonator frequency divided by 4.5 for the remainder of the device cycle.

When used with an external 420-kHz ceramic resonator, the device internal blanking disables the receive input (REC) for 3.8 ms after initiate to exclude false receive inputs that may be caused by transducer ringing. The internal blanking feature also eliminates echos from objects closer than 1.3 feet from the transducer. If it is necessary to detect objects closer than 1.3 feet, then the internal blanking may be shortened by taking the blanking inhibit (BINH) high, enabling the receive input. The blanking input (BLNK) may be used to disable the receive input and reset ECHO to a low logic level at any time during the device cycle for selective echo exclusion or for a multiple-echo mode of operation.

The device provides a synchronous 4-bit gain control output (12 steps) designed to control the gain of the TL852 sonar ranging receiver integrated circuit. The digital gain control waveforms are shown in Figure 2 with the nominal transition times from INIT listed in the Gain Control Output Table.

The threshold of the internal receive level detector is 1.2 V. The TL851 operates over a supply voltage range of 4.5 V to 6.8 V and is characterized for operation from 0°C to 40°C.

# TL851 SONAR RANGING CONTROL

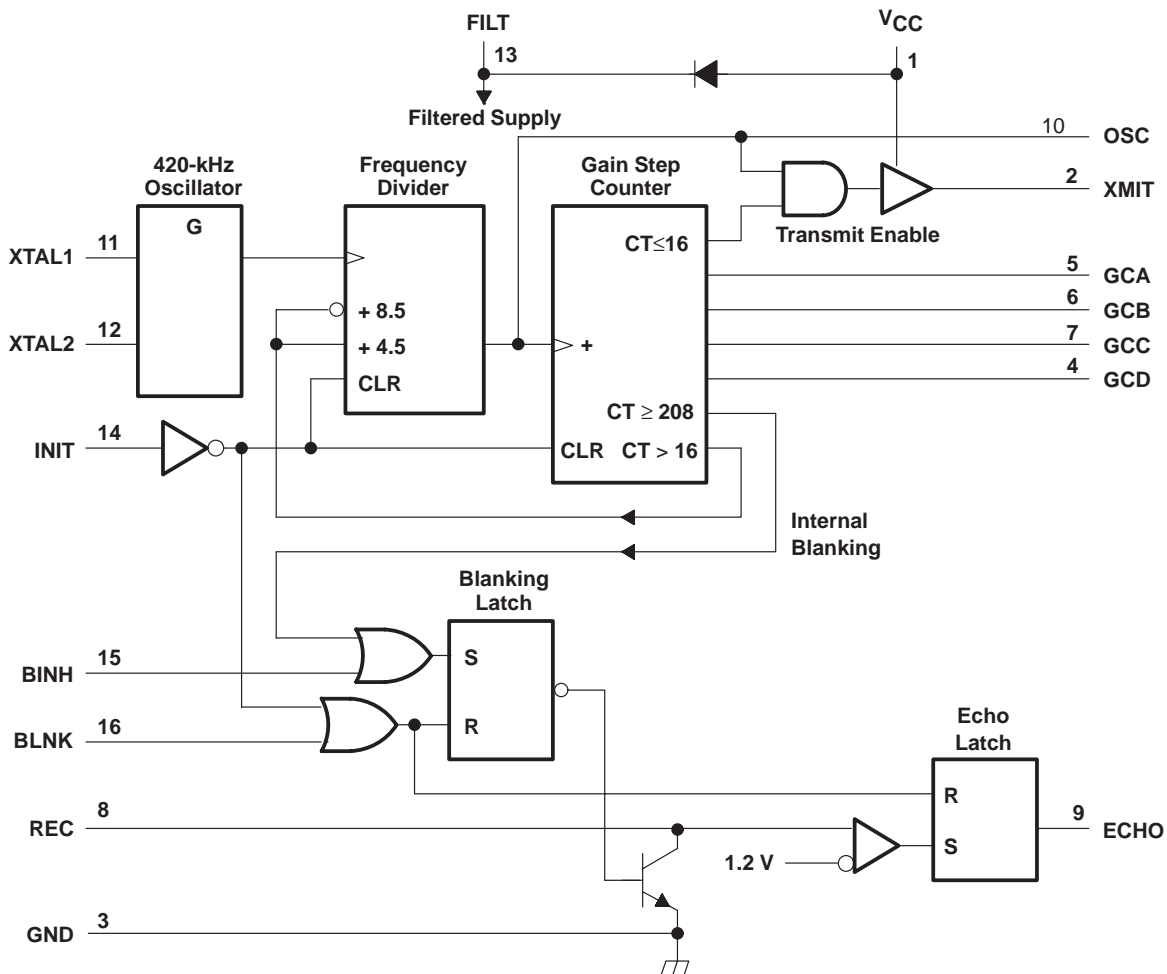
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GAIN CONTROL OUTPUT TABLE

STEP NUMBER	GCD	GCC	GCB	GCA	TIME (ms) FROM INITIATE <sup>††</sup>
0	L	L	L	L	2.38 ms
1	L	L	L	H	5.12 ms
2	L	L	L	L	7.87 ms
3	L	L	H	H	10.61 ms
4	L	H	L	L	13.35 ms
5	L	H	L	H	16.09 ms
6	L	H	H	L	18.84 ms
7	L	H	H	H	21.58 ms
8	H	L	L	L	27.07 ms
9	H	L	L	H	32.55 ms
10	H	L	H	L	38.04 ms
11	H	L	H	H	INIT ↓

<sup>††</sup>This is the time to the end of the indicated step and assumes a nominal 420-kHz ceramic resonator.

## functional block diagram



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

Voltage range at any pin with respect to GND .....	– 0.5 V to 7 V
Voltage range at any pin with respect to $V_{CC}$ .....	– 7 V to 0.5 V
Continuous total dissipation at (or below) 25°C free-air temperature (see Note 1) .....	1150 mW
Operating free-air temperature range .....	0°C to 40°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, $V_{IH}$	BLNK, BINH, INIT	2.1		V
Low-level input voltage, $V_{IL}$	BLNK, BINH, INIT		0.6	V
Delay time, power up to INIT high		5		ms
Operating free-air temperature, $T_A$		0	40	°C

**electrical characteristics over recommended ranges of supply voltage and operating free-air temperature**

PARAMETER		TEST CONDITIONS	MIN	TYP‡	MAX	UNIT
Input current	BLNK, BINH, INIT	$V_I = 2.1$ V			1	mA
High-level output current, $I_{OH}$	ECHO, OSC, GCA, GCB, GCC, GCD	$V_{OH} = 5.5$ V			100	µA
Low-level output current, $I_{OL}$	ECHO, OSC, GCA, GCB, GCC, GCD	$I_{OL} = 1.6$ mA			0.4	V
On-state output current	SMIT output	$V_O = 1$ V			–140	mA
Internal blanking interval	REC input				2.38§	ms
Frequency during 16-pulse transmit period	OSC output				49.4§	kHz
	XMIT output				49.4§	
Frequency after 16-pulse transmit period	OSC output				93.3§	kHz
	XMIT output				0	
Supply current, $I_{CC}$	During transmit period				260	mA
	After transmit period				55	

‡ Typical values are at  $V_{CC} = 5$  V and  $T_A = 25$ °C.

§ These typical values apply for a 420-kHz ceramic resonator.

# TL851 SONAR RANGING CONTROL

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## schematics of inputs and outputs

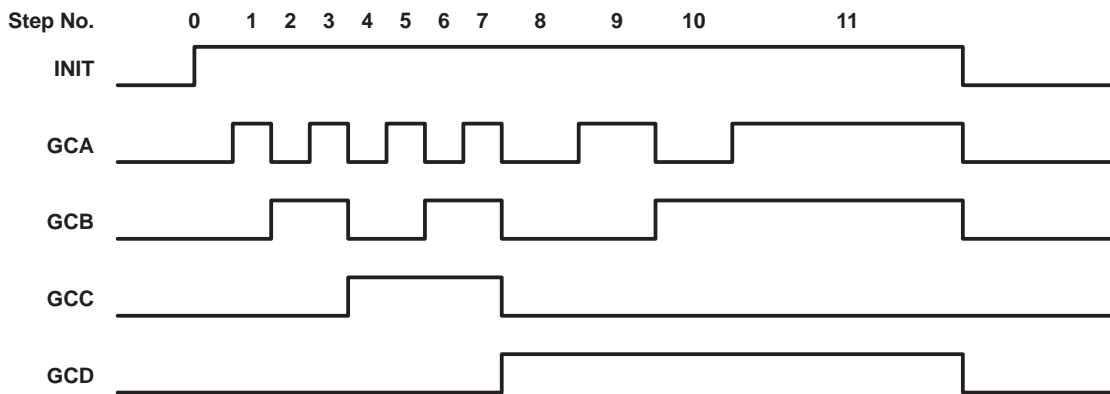
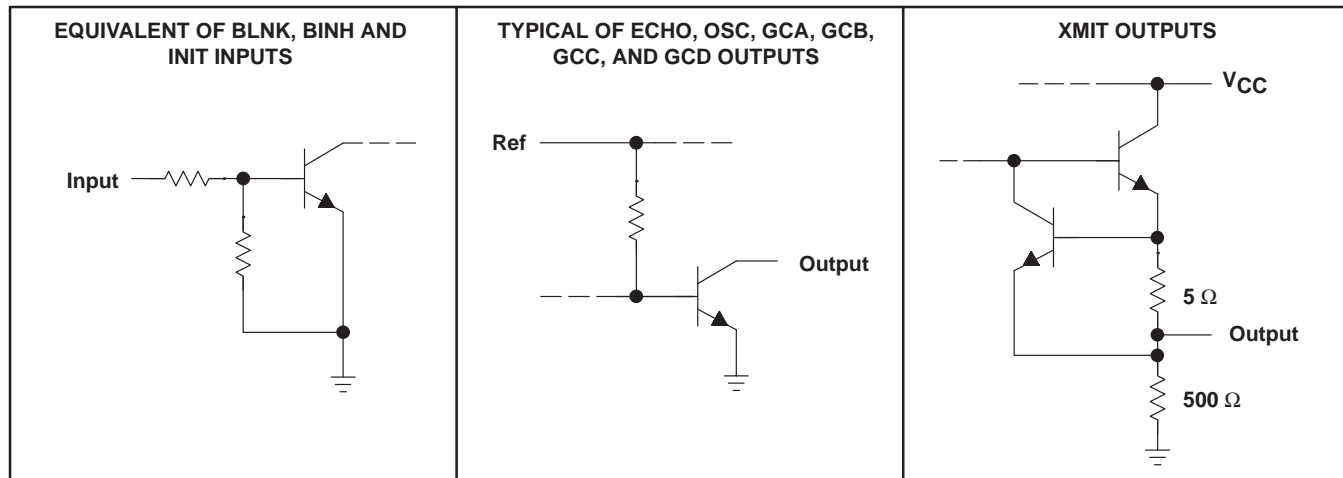


Figure 1. Digital Gain Control Waveforms

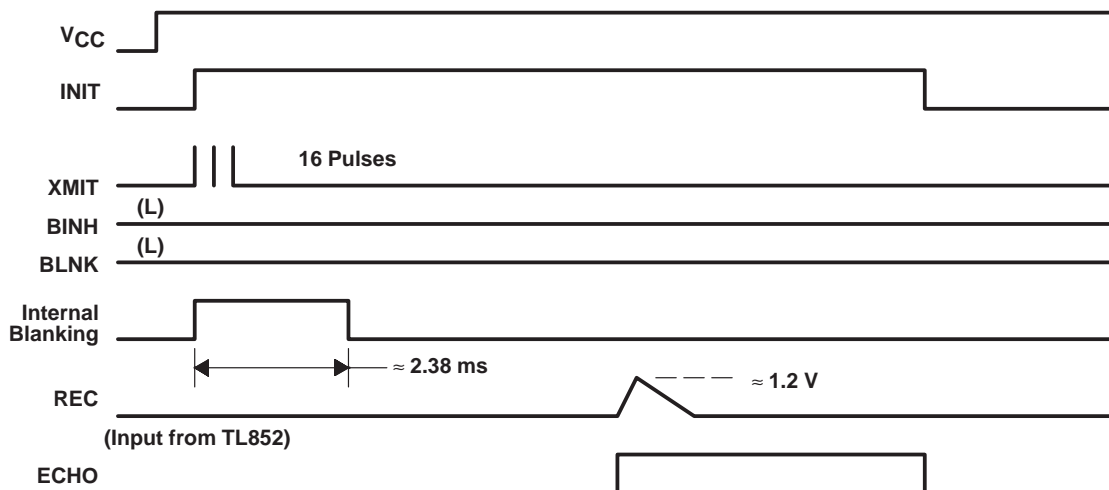


Figure 2. Example of Single-Echo-Mode Cycle When Used With the TL852 Receiver and 420-kHz Ceramic Resonator

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TL851CD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TL851C	<a href="#">Samples</a>
TL851CDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TL851C	<a href="#">Samples</a>
TL851CDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TL851C	<a href="#">Samples</a>
TL851CDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TL851C	<a href="#">Samples</a>
TL851CDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TL851C	<a href="#">Samples</a>
TL851CN	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type		TL851CN	<a href="#">Samples</a>
TL851CN	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type		TL851CN	<a href="#">Samples</a>
TL851CNE4	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type		TL851CN	<a href="#">Samples</a>
TL851CNE4	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type		TL851CN	<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.

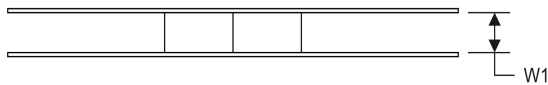
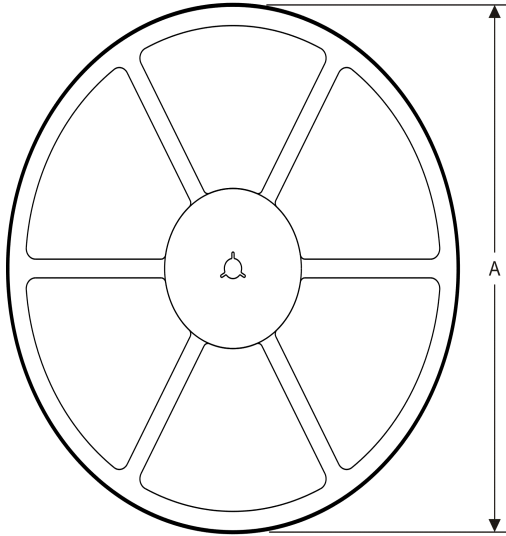
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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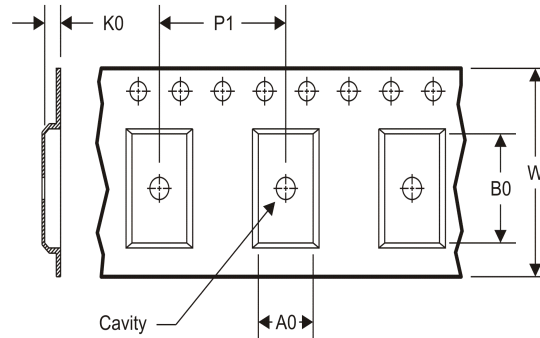
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**TAPE AND REEL INFORMATION**

**REEL DIMENSIONS**



**TAPE DIMENSIONS**



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**TAPE AND REEL INFORMATION**

\*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
TL851CDR	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)
TL851CDR	SOIC	D	16	2500	367.0	367.0	38.0

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.
  -  C. 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.
  -  D. 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.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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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