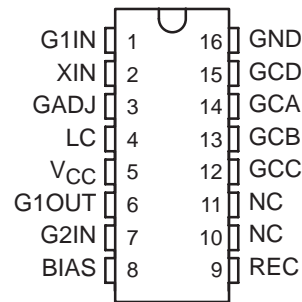


- **Designed for Use With the TL851 in Sonar Ranging Modules Like the SN28827**
- **Digitally Controlled Variable-Gain Variable-Bandwidth Amplifier**
- **Operational Frequency Range of 20 kHz to 90 kHz**
- **TTL-Compatible**
- **Operates From Power Sources of 4.5 V to 6.8 V**
- **Interfaces to Electrostatic 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 Ω \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 Ω and 20 k Ω .

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 μ 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 Ω 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- μ A current source. When an input of sufficient amplitude is received, the output is driven alternately by the 1- μ A discharge current and a 50- μ 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.

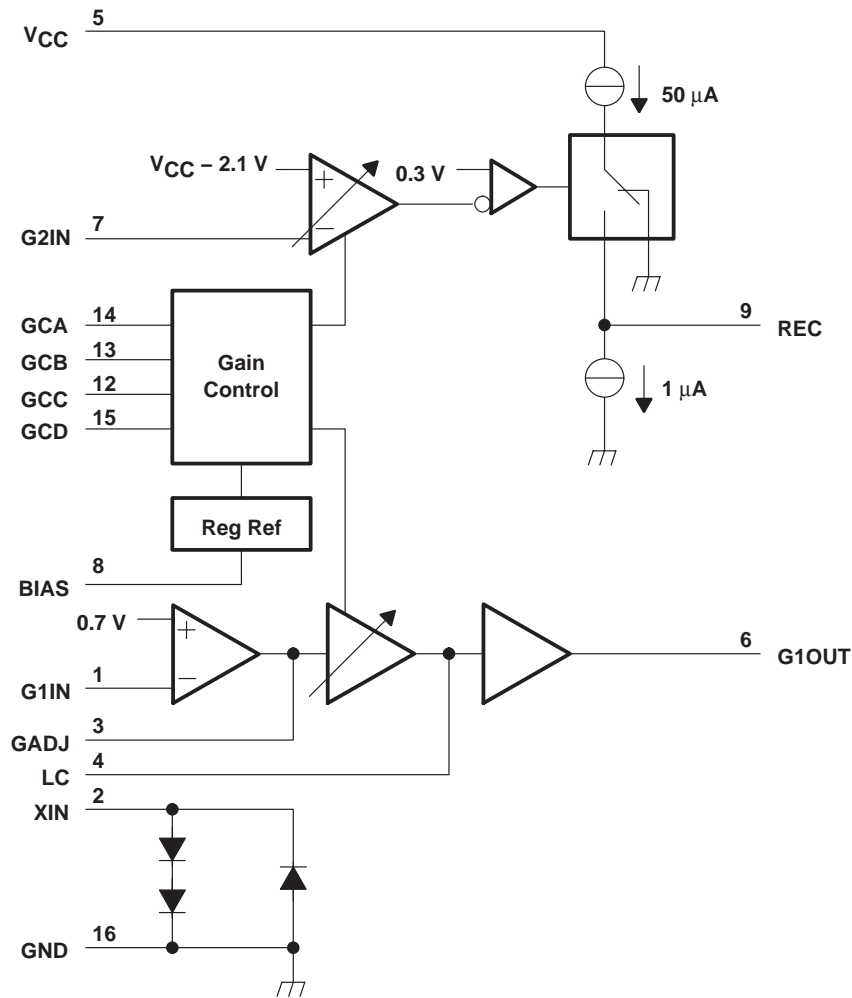
XIN provides clamping for the transformer secondary when used for transducer transmit drive as shown in Figure 4 of the SN28827 data sheet.

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

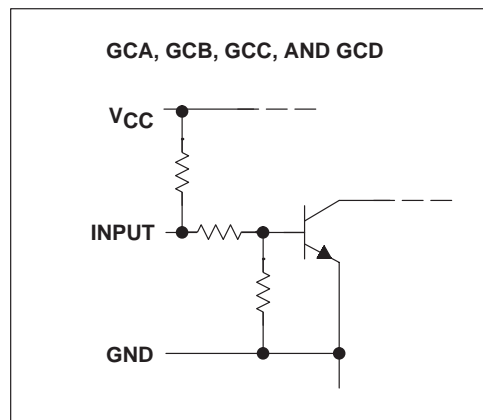
TL852 SONAR RANGING RECEIVER

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)	± 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 Ω
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	$I_{G2IN} = -100$ μ A, $V_O = 0.3$ V		1		μ A
	$I_{G2IN} = 100$ μ A, $V_O = 0.1$ V		– 50		
Supply current, I_{CC}				45	mA

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



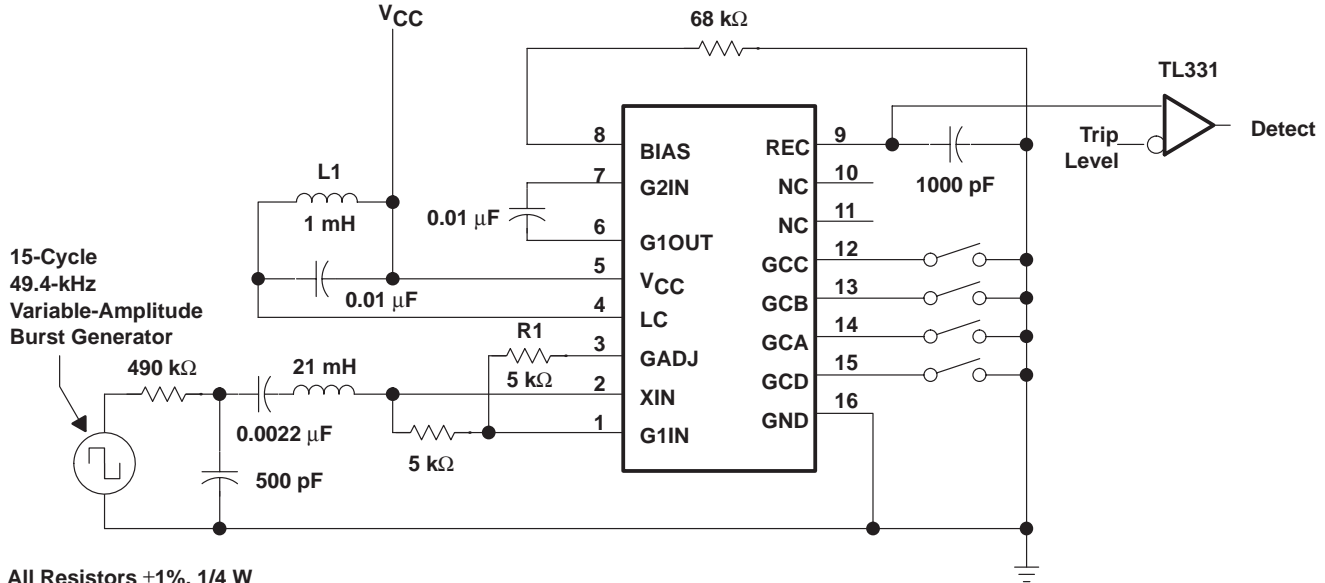
TL852 SONAR RANGING RECEIVER

SLSS003 – SEPTEMBER 1983 – REVISED MARCH 1988

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

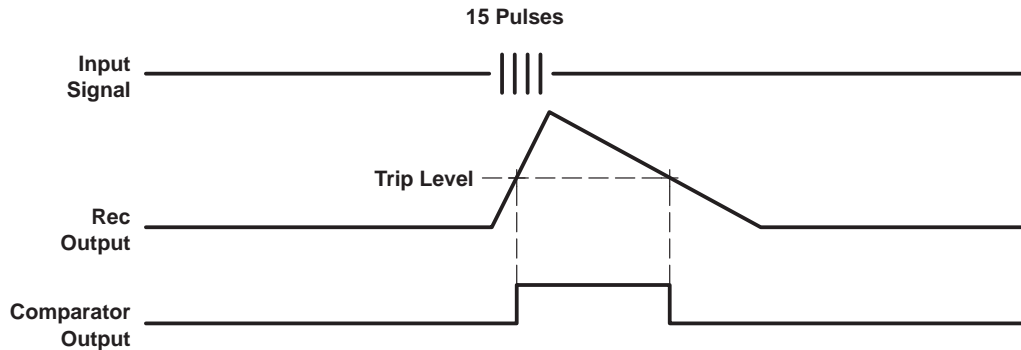


Figure 1. Detect-Level Measurement Circuit and Waveforms

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

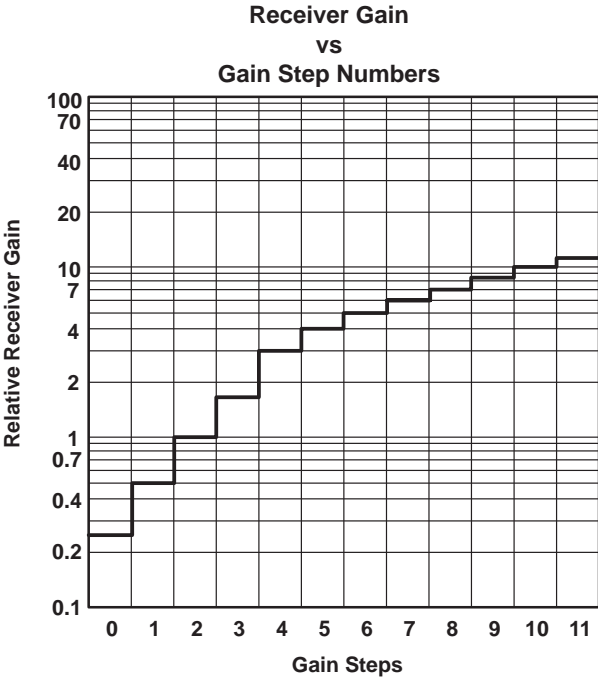


Figure 2



PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TL852CDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL852CDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL852CDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL852CN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL852CN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL852CNE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL852CNE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

⁽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.

OBSELETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

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

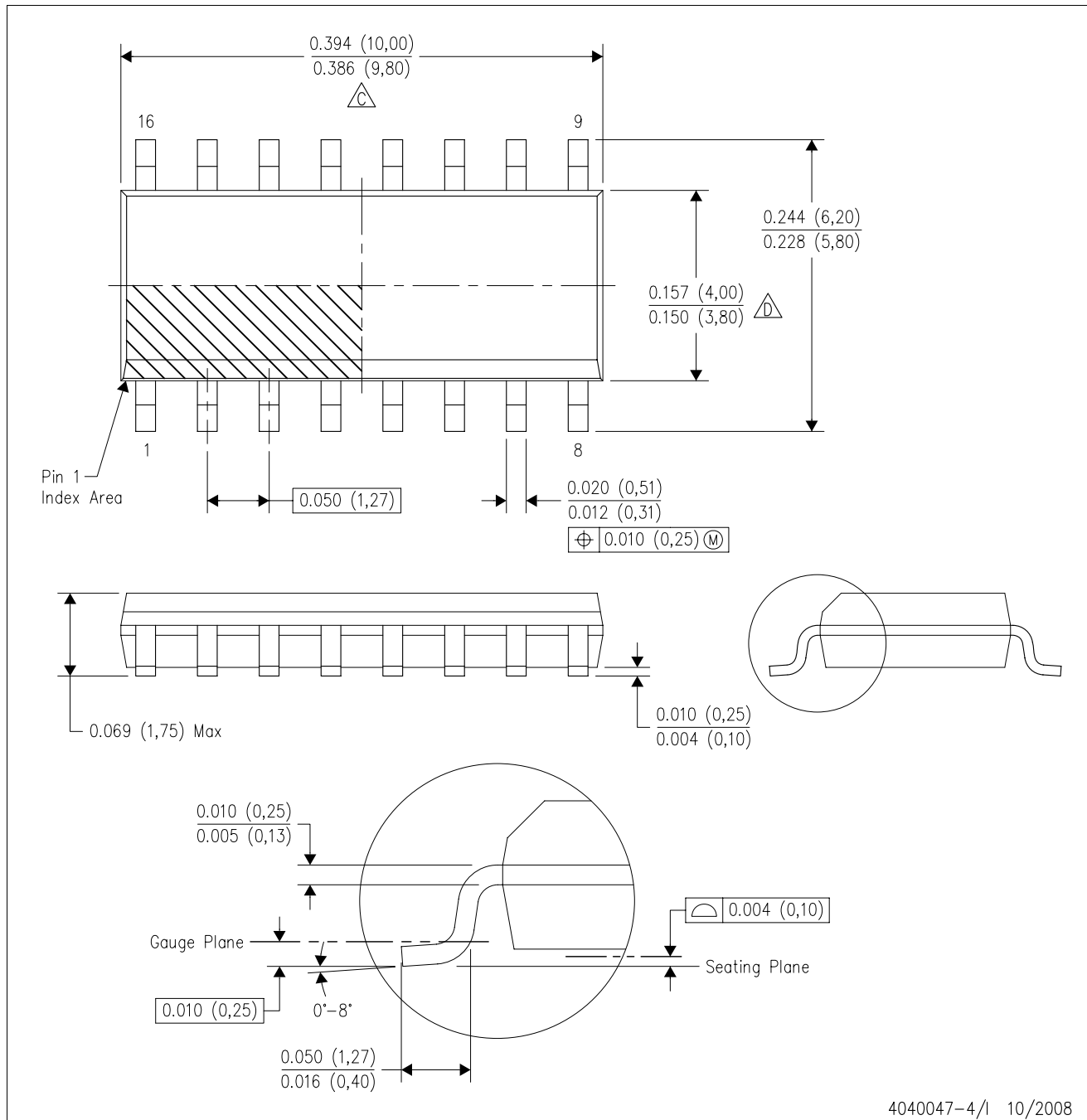


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL852CDR	SOIC	D	16	2500	346.0	346.0	33.0

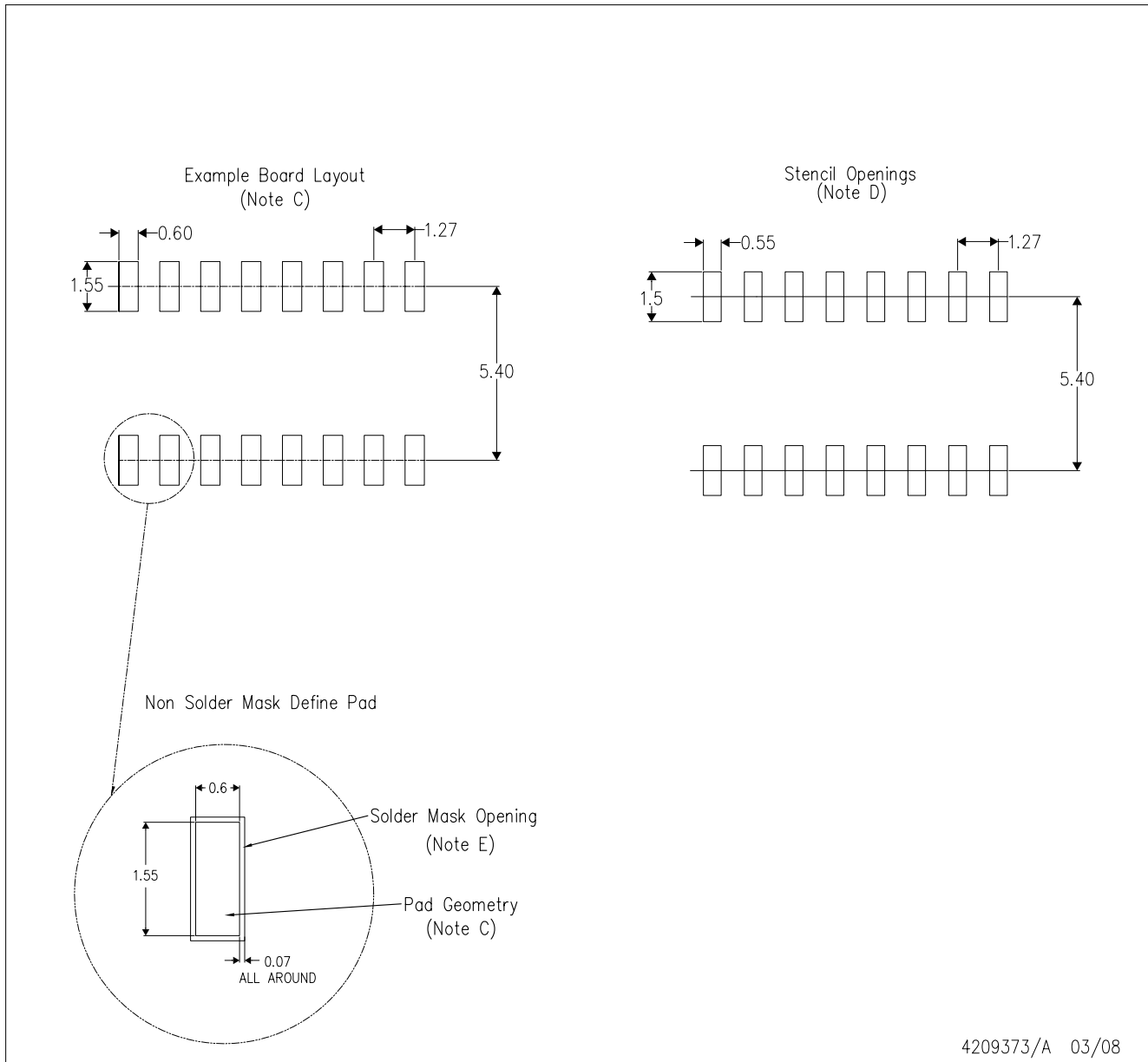
D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



- 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 .006 (0,15) per end.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
 - E. Reference JEDEC MS-012 variation AC.

D(R-PDSO-G16)



4209373/A 03/08

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Refer to IPC7351 for alternate board design.
 - 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
 - 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



4040049/E 12/2002

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

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2008, Texas Instruments Incorporated