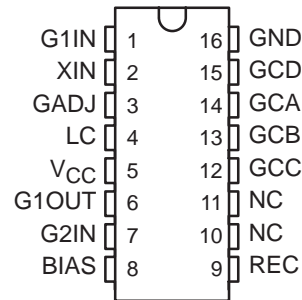- **Designed for Use With the TL851 in Sonar Ranging Modules Like the SN28827**
- **Digitally Controlled Variable-Gain Variable-Bandwidth Amplifier**
- **Operational Frequency Range of 20 kHz to 90 kHz**
- **TTL-Compatible**
- **Operates From Power Sources of 4.5 V to 6.8 V**
- **Interfaces to Electrostatic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

N PACKAGE
(TOP VIEW)

G1IN	1	16 GND
XIN	2	15 GCD
GADJ	3	14 GCA
LC	4	13 GCB
V_{CC}	5	12 GCC
G1OUT	6	11 NC
G2IN	7	10 NC
BIAS	8	9 REC

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-kΩ ±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 kΩ and 20 kΩ

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 µs) 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-kΩ resistor from G1IN to XIN is recommended.

An external parallel combination of inductance and capacitance between LC and V_{CC} 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-µA current source. When an input of sufficient amplitude is received, the output is driven alternately by the 1-µA discharge current and a 50-µA 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.
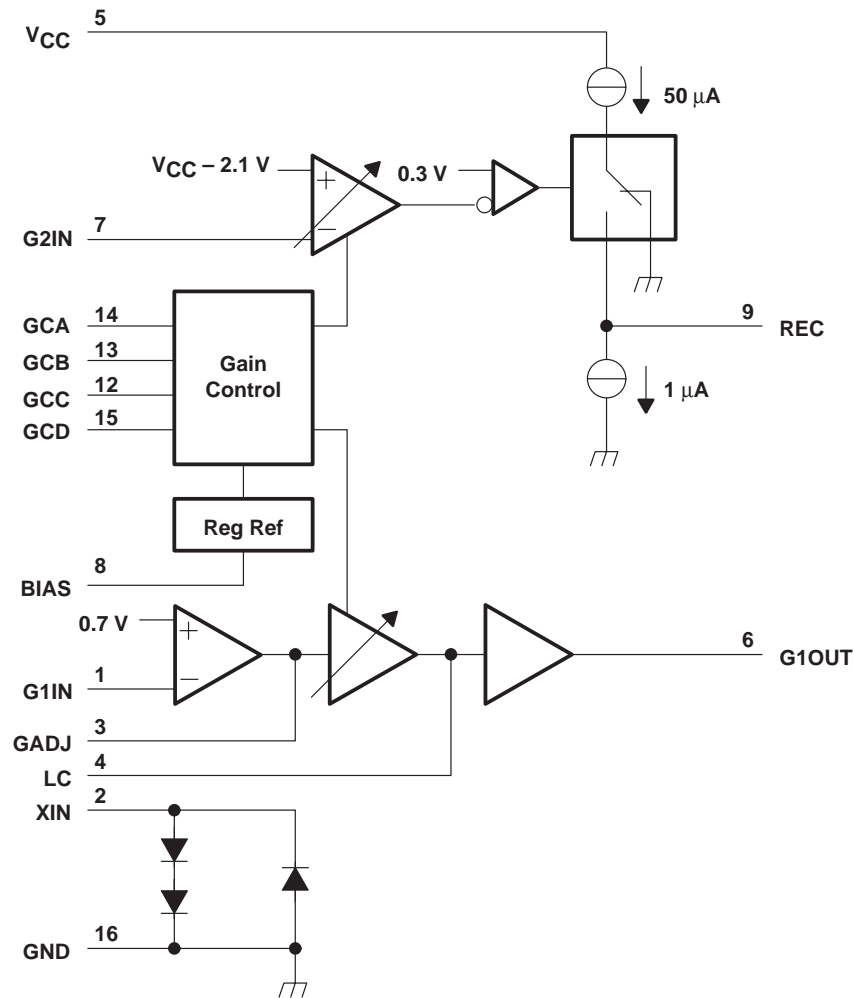
XIN provides clamping for the transformer secondary when used for transducer transmit drive as shown in Figure 4 of the SN28827 data sheet.

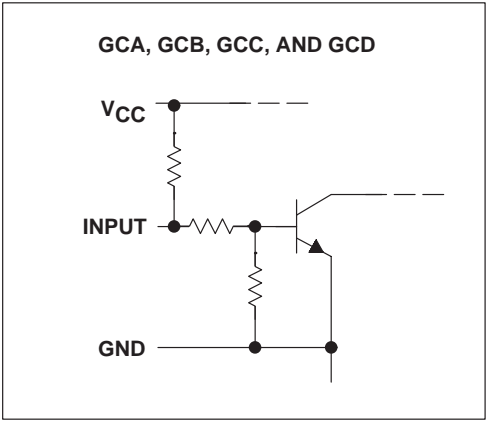The TL852 is characterized for operation from 0°C to 40°C.

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TEXAS
INSTRUMENTS

TL852
SONAR RANGING RECEIVER

functional block diagram

schematic of gain control inputs

2

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}	GCA, GCB, GCC, GCD	2.1		V
Low-level input voltage, V_{IL}			0.6	
Bias resistor between BIAS and GND		64	72	kΩ
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
Raceive output current	I_{G2IN} = − 100 μA,	V_O = 0.3 V		1		μA
	I_{G2IN} = 100 μA,	V_O = 0.1 V		− 50		
Supply current, I_{CC}					45	mA

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

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.
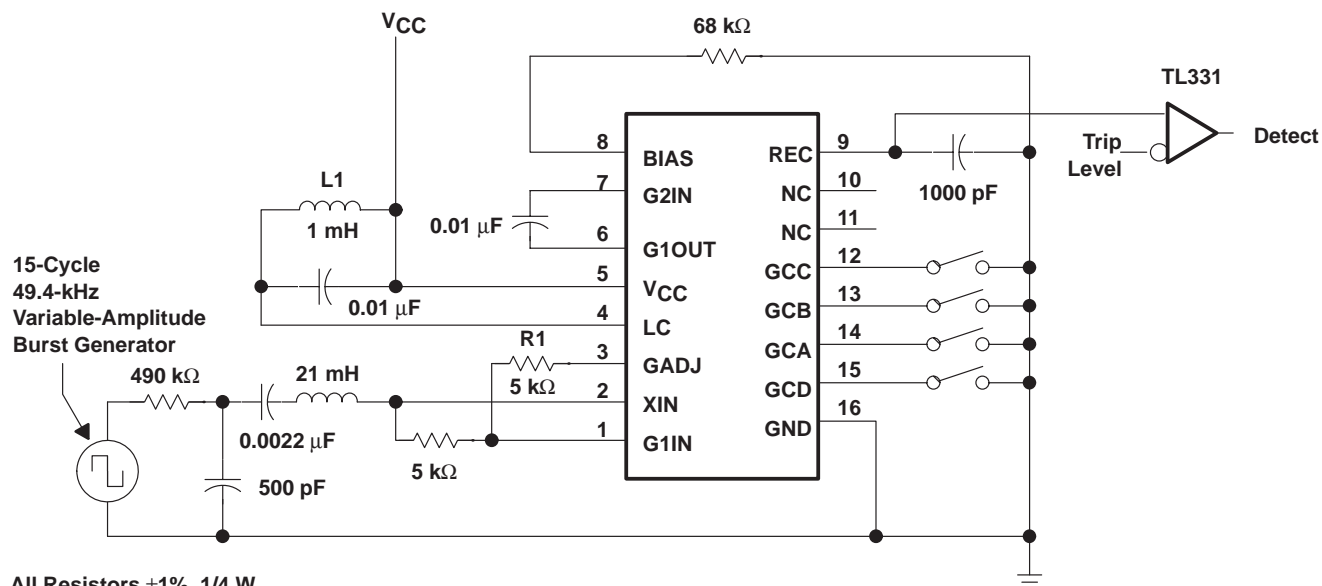
All Resistors ±1%, 1/4 W
All Capacitors ±1%, Film
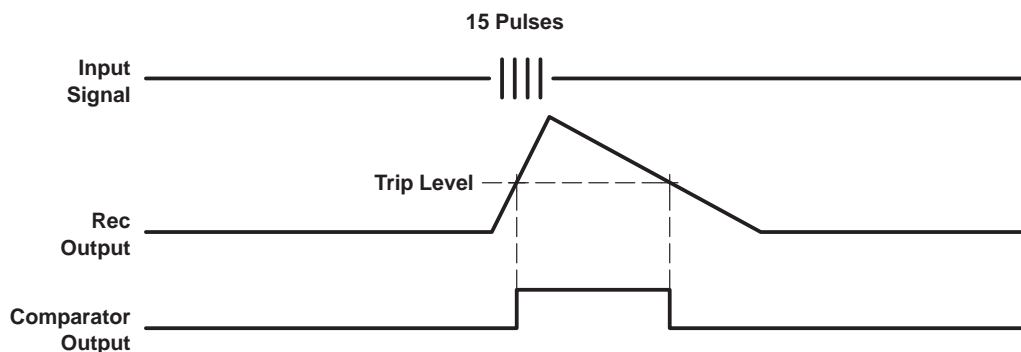**L1 Q > 60 at 50 kHz**
C1 Q > 500 at 50 kHz

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
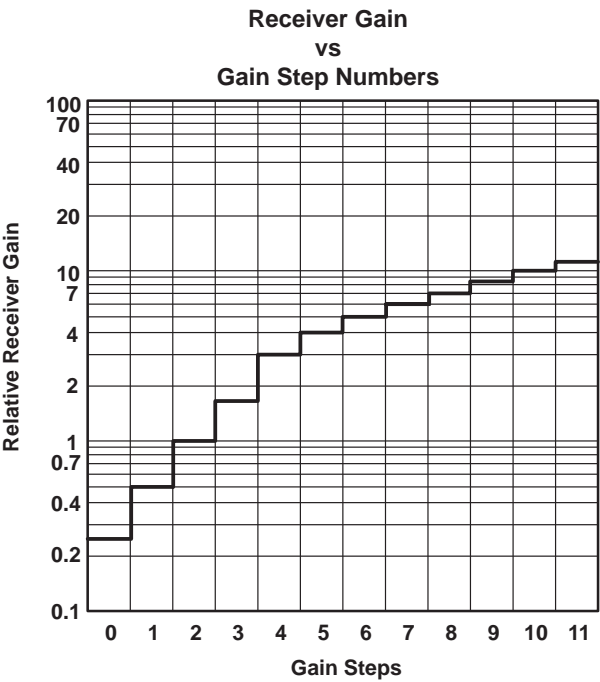
Figure 2

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.
OBSOLETE: 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.

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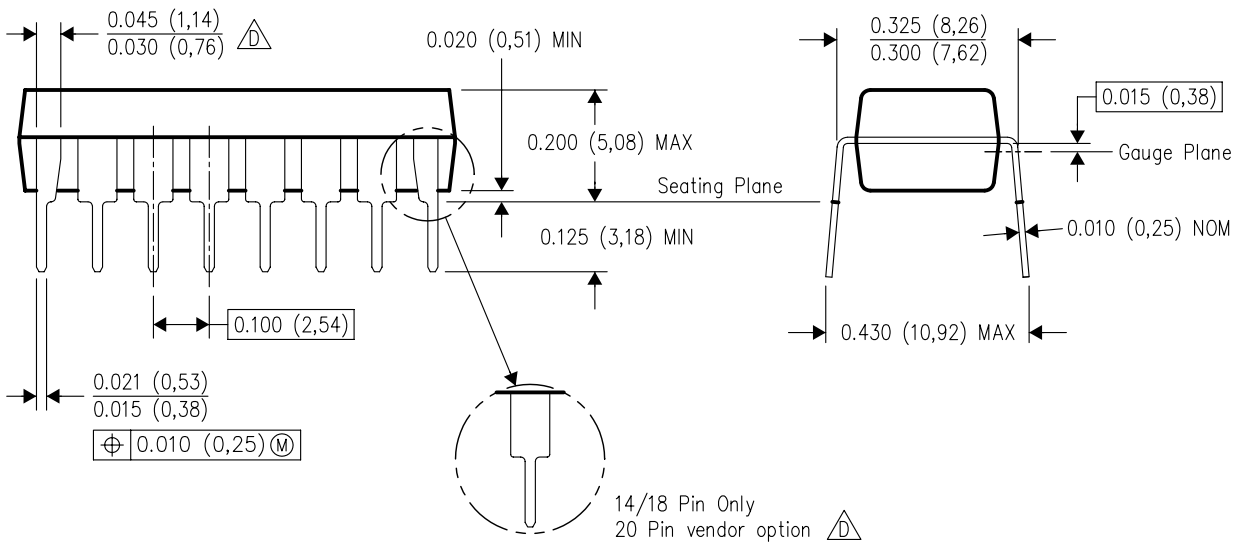
N (R−PDIP−T**) PLASTIC DUAL−IN−LINE PACKAGE
16 PINS SHOWN

DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS−001 VARIATION	AA	BB	AC	AD

0.260 (6,60) / 0.240 (6,10)

0.070 (1,78) / 0.045 (1,14) △D

0.045 (1,14) / 0.030 (0,76) △D

0.020 (0,51) MIN

0.200 (5,08) MAX

Seating Plane

0.125 (3,18) MIN

0.100 (2,54)

0.021 (0,53) / 0.015 (0,38)

⊕ 0.010 (0,25) Ⓜ

14/18 Pin Only
20 Pin vendor option △D

0.325 (8,26) / 0.300 (7,62)

0.015 (0,38)

Gauge Plane

0.010 (0,25) NOM

0.430 (10,92) MAX

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.

D (R−PDSO−G16) PLASTIC SMALL−OUTLINE PACKAGE
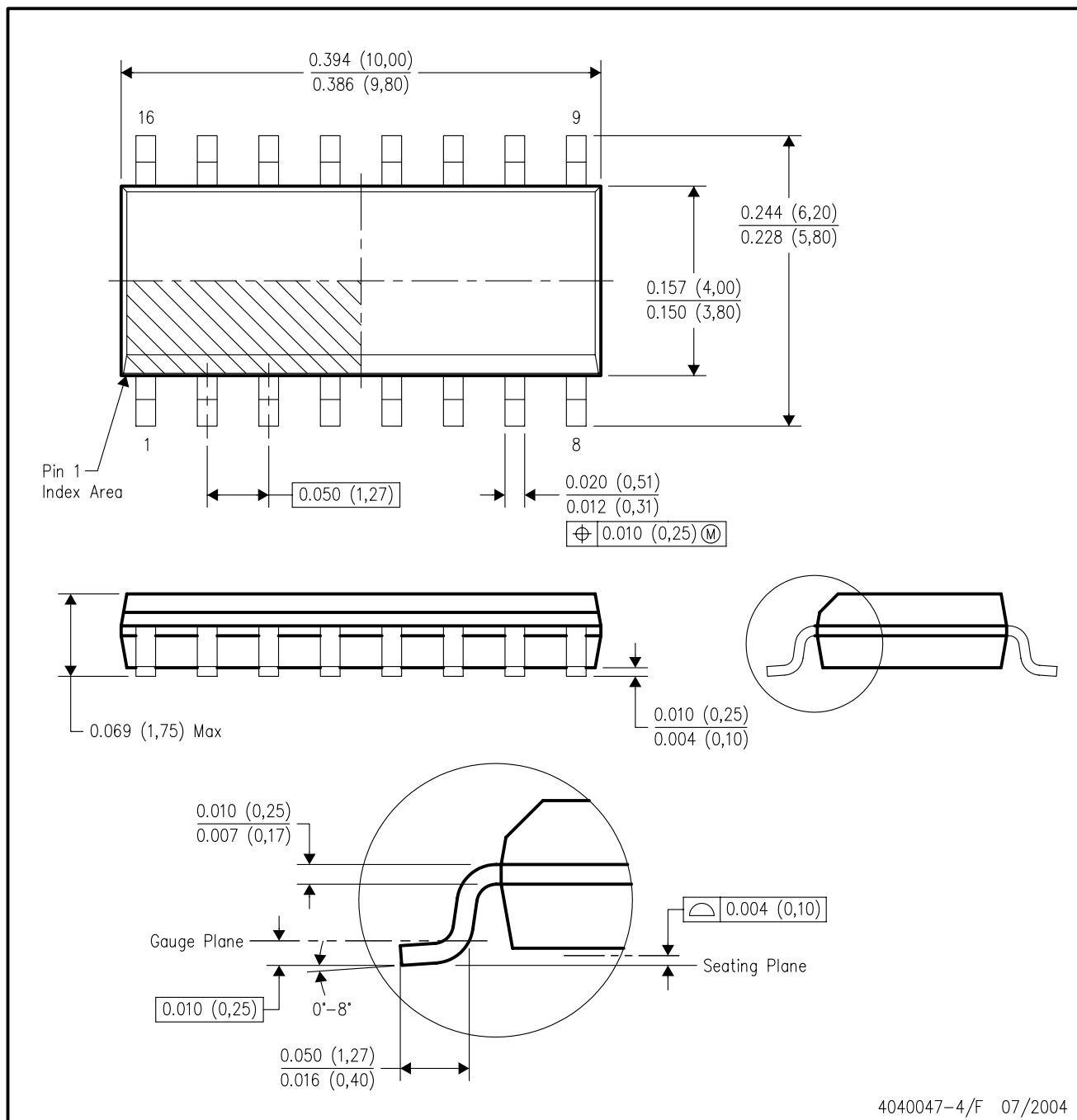
0.394 (10,00)
0.386 (9,80)

16

9

0.244 (6,20)
0.228 (5,80)

0.157 (4,00)
0.150 (3,80)

1

8

Pin 1
Index Area

0.050 (1,27)

0.020 (0,51)
0.012 (0,31)

⊕ 0.010 (0,25) Ⓜ

0.069 (1,75) Max

0.010 (0,25)
0.004 (0,10)

0.010 (0,25)
0.007 (0,17)

0.004 (0,10)

Gauge Plane

Seating Plane

0.010 (0,25)

0°−8°

0.050 (1,27)
0.016 (0,40)

4040047−4/F   07/2004

NOTES: A. All linear dimensions are in inches (millimeters).
        B. This drawing is subject to change without notice.
        C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
        D. Falls within JEDEC MS−012 variation AC.

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