TWO-PHASE HALF-WAVE MOTOR PREDRIVER

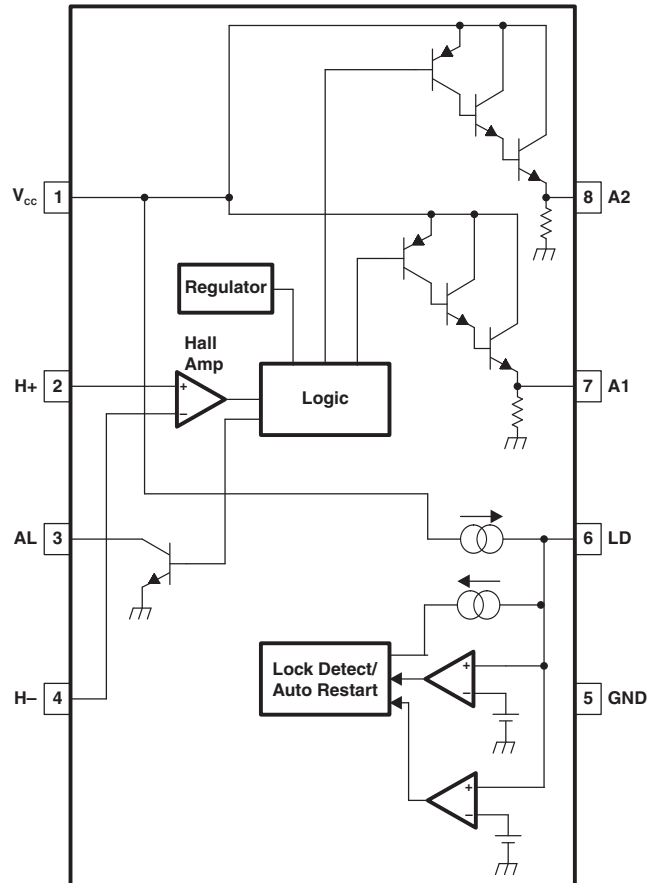## FEATURES

- **Built-In Lock Detection and Rotational Speed Sensing Mechanisms**
- **Compact 8-Pin Package Reduces Number of External Components Required**
- **Automatic Restart When Motor Lock Is Undone**
- **Hall Amplifier Inputs Have Hysteresis**

DESCRIPTION

The TMP821 is a two-phase half-wave motor predriver suited for fan motors.

BLOCK DIAGRAM

ORDERING INFORMATION[1]

TJ	PACKAGE[2]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 125°C	SOIC – D	Reel of 2500	TMP821DR	TMP821

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

TEXAS INSTRUMENTS
www.ti.com

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PIN ASSIGNMENTS

D PACKAGE
(TOP VIEW)

V_{CC}	1		8	A2
H+	2		7	A1
AL	3		6	LD
H−	4		5	GND
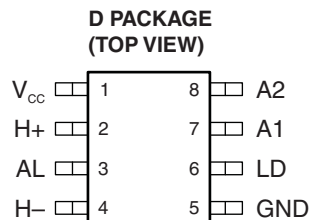
TERMINAL FUNCTIONS

TERMINAL		DESCRIPTION
NAME	NO.	
VCC	1	Power input (4 V to 28 V)
H+	2	Positive Hall input
AL	3	Speed indication Note: May remain high for several hundred milliseconds after power-on.
H−	4	Negative Hall input
GND	5	Ground
LD	6	Timing capacitor
A1	7	Driver output
A2	8	Driver output

ABSOLUTE MAXIMUM RATINGS[1]

over operating free-air temperature range (unless otherwise noted)

		VALUE	UNIT
V_{CC}	Supply voltage	30	V
V_{AL}	Output voltage (AL)	30	V
I_{OUT}	Continuous output current (A1, A2)	70	mA
I_{AL}	Continuous output current (AL)	8	mA
θ_{JA}	Package thermal impedance[2]	97	°C/W
T_J	Operating junction temperature range	–40 to 125	°C
T_{stg}	Storage temperature range	–55 to 150	°C

(1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) Package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS

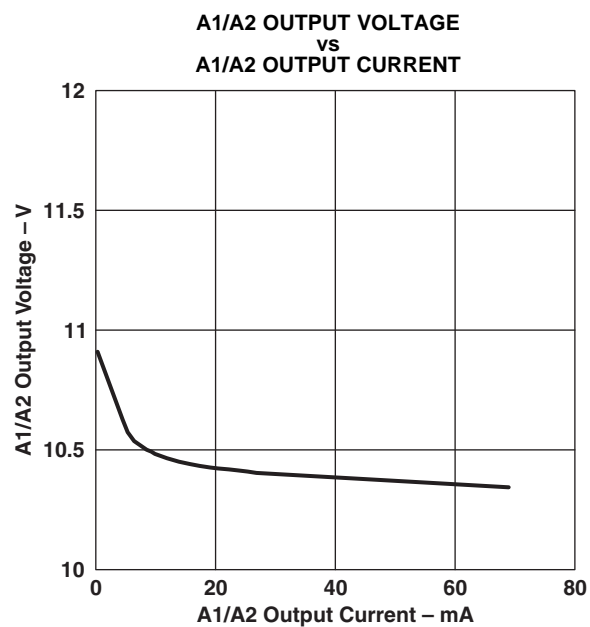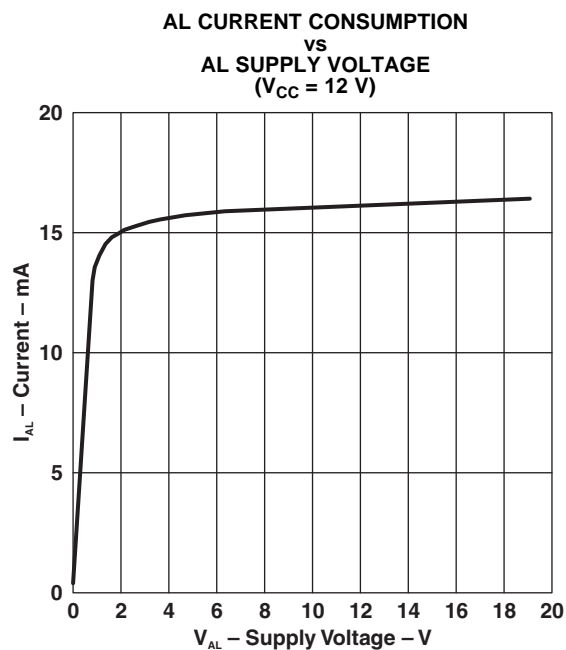over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V_{CC}	Supply voltage	4	28	V
V_H	Hall amplifier input voltage	1	$V_{CC} - 0.5$	V
T_A	Operating free-air temperature	–40	100	°C

ELECTRICAL CHARACTERISTICS

V_{CC} = 12 V, T_A = 25°C (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{HYS}	Hall amplifier input voltage hysteresis			±3		±15	mV
V_{AL}	Lock alarm signal low-level output voltage	AL	I_{AL} = 5 mA			0.5	V
I_{AL}	Lock alarm signal low-level output current	AL	V_{AL} = 2 V	8			mA
I_{LDC}	Lock detection capacitor charge current	LD	V_{LD} = 1.5 V	2	3.45	5.25	μA
I_{LDD}	Lock detection capacitor discharge current	LD	V_{LD} = 1.5 V	0.35	0.8	1.45	μA
r_{CD}	Lock detection capacitor charge/discharge current ratio	LD	$r_{CD} = I_{LDC}/I_{LDD}$	3	4.5	8	
V_{LDCL}	Lock detection capacitor clamp voltage	LD		2.2	2.6	3	V
V_{LDCP}	Lock detection capacitor comparator voltage	LD		0.4	0.6	0.8	V
V_{7H}	High-level output voltage	A1	I_{OH} = –10 mA	10	10.5		V
V_{8H}	High-level output voltage	A2	I_{OH} = –10 mA	10	10.5		V
I_{CC}	Supply current		Output off		3.2	5	mA

TEXAS
INSTRUMENTS
www.ti.com

TYPICAL CHARACTERISTICS

AL CURRENT CONSUMPTION
vs
AL SUPPLY VOLTAGE
(V_{CC} = 12 V)

A1/A2 OUTPUT VOLTAGE
vs
A1/A2 OUTPUT CURRENT

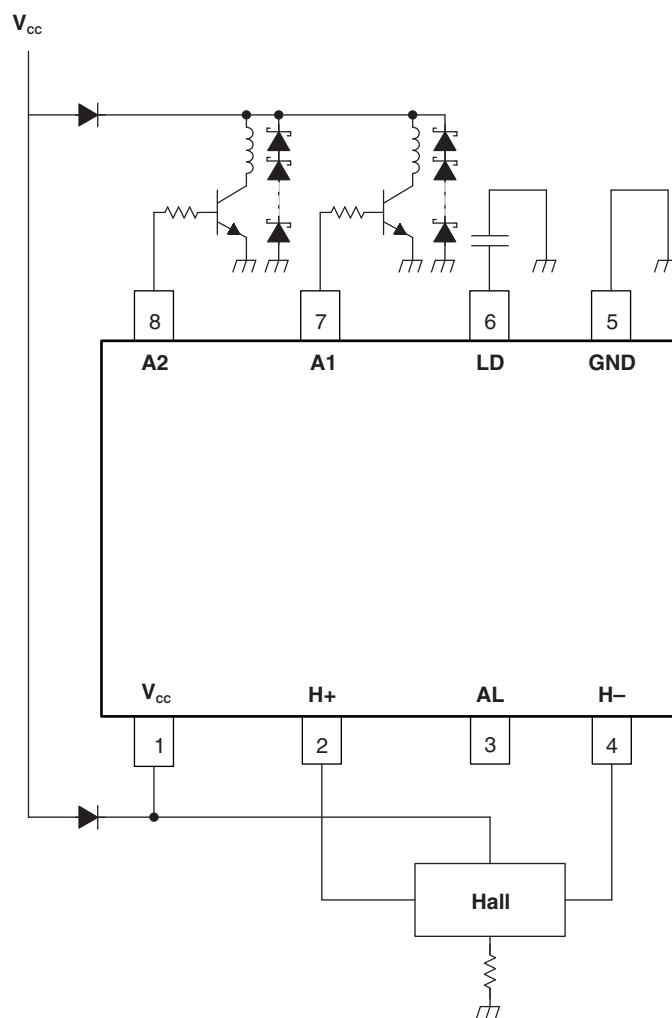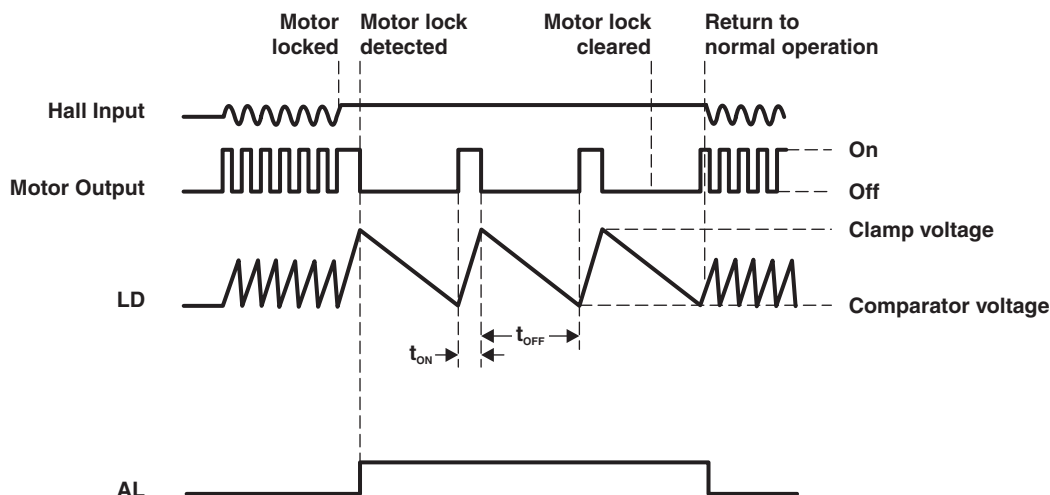## APPLICATION INFORMATION

Figure 1. Typical Application Circuit

Lock Detection

When a motor lock is detected, the TMP821 automatically shuts down its output current. When the motor lock is removed, the TMP821 automatically restarts. Motor lock is detected when the Hall signal stops switching, as shown in Figure 2.

Figure 2.

t_{ON} and t_{OFF} are determined by the capacitor connected to LD:

$$t_{ON} = (C_{LD} \times (V_{LD\_CLAMP} - V_{LD\_COMP}) / I_{LD\_CHARGE} \text{ (seconds)}$$
$$t_{OFF} = (C_{LD} \times (V_{LD\_CLAMP} - V_{LD\_COMP}) / I_{LD\_DISCHARGE} \text{ (seconds)}$$

Where:

C_{LD} = capacitance of the external capacitor on LD

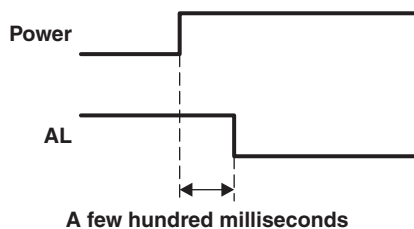V_{LD_CLAMP} = LD clamp voltage

V_{LD_COMP} = LD comparator voltage

I_{LD_CHARGE} = LD charge current

$I_{LD\_DISCHARGE}$ = LD discharge current

NOTE:

After power is supplied to the device, the the lock detection pin (AL) may remain high for a few hundred milliseconds (see Figure 3).

Figure 3. Power-On to AL Delay

Power Dissipation

Figure 4 shows allowable power dissipation versus ambient temperature.
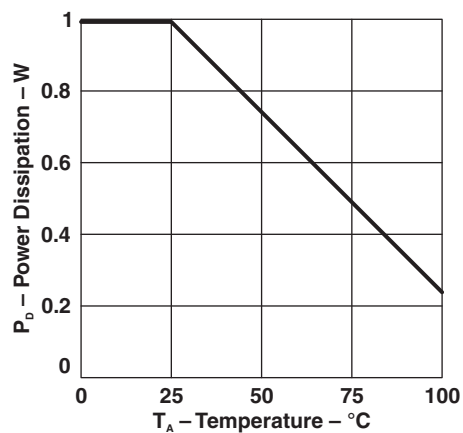
Figure 4. Power Dissipation

Total power consumption can be calculated as shown in Equation 1.

$$P_{total} = P_{C1} + P_{C2} + P_{C3} \tag{1}$$

Where:

  P_{C1} = circuit power dissipation

   $P_{C1} = V_{CC} \times I_{CC}$

  P_{C2} = output power dissipation

   $P_{C2} = (V_{CC} - V_{OH}) \times I_{O}$

   V_{OH} = A1 and A2 high-level voltage

   P_{C2} can be reduced by increasing the external output transistor's hFE rank to reduce the I_{O} consumption.

  P_{C3} = AL power dissipation

   $P_{C3} = V_{AL\_LOW} \times I_{AL}$

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
TMP821DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TMP821DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

[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.

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

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

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
TMP821DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TMP821DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TMP821DR	SOIC	D	8	2500	340.5	338.1	20.6
TMP821DR	SOIC	D	8	2500	346.0	346.0	29.0

D (R−PDSO−G8)   PLASTIC SMALL−OUTLINE PACKAGE

0.197 (5,00)
0.189 (4,80)
C

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

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

8   5

Pin 1
Index Area

1   4

0.050 (1,27)

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

⊕ 0.010 (0,25) M

0.069 (1,75) Max

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

0.010 (0,25)
0.005 (0,13)

Gauge Plane

0.004 (0,10)

Seating Plane

0.010 (0,25)

0°−8°

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

4040047−3/J 09/09
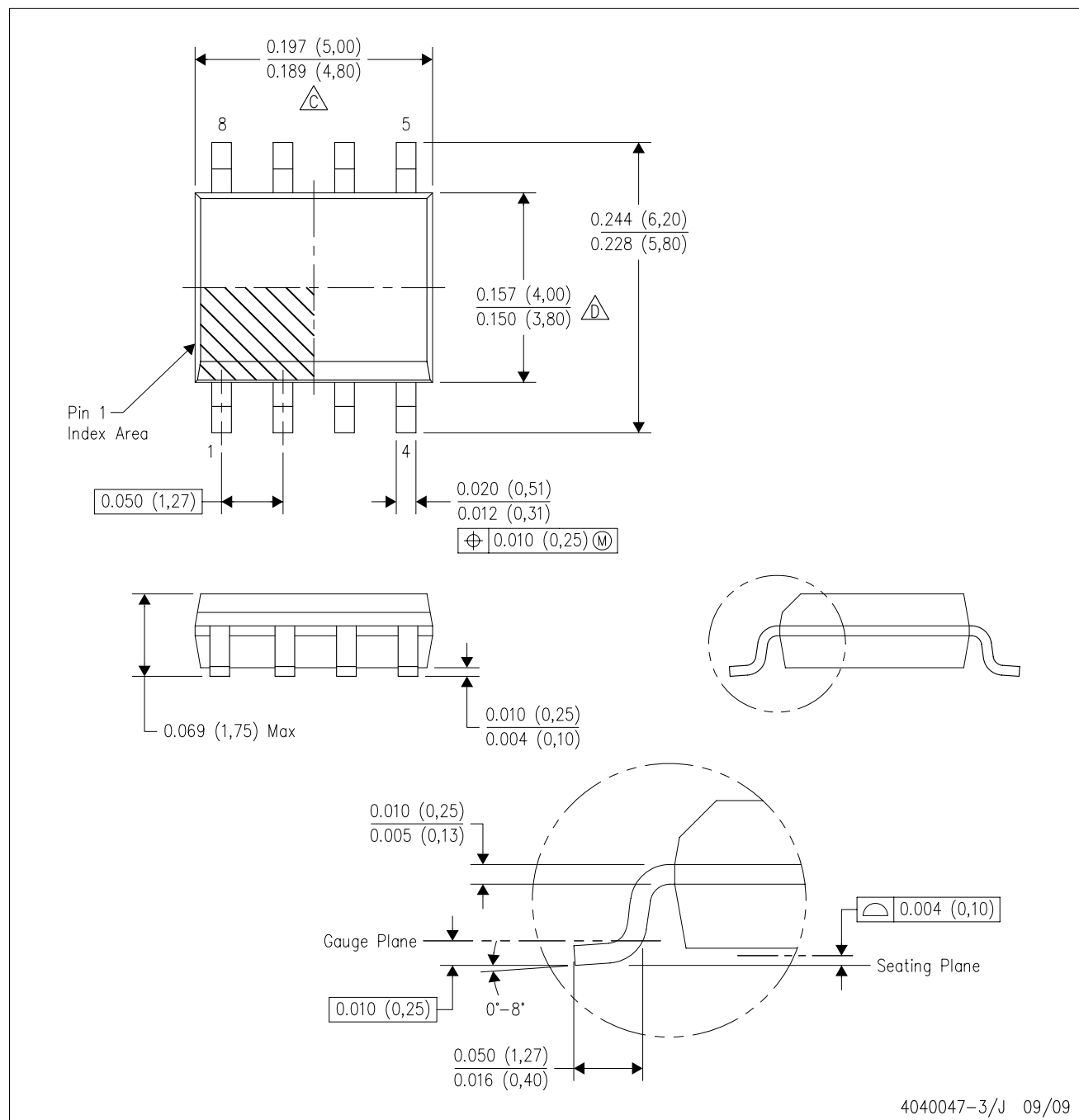
NOTES: A. All linear dimensions are in inches (millimeters).
         B. This drawing is subject to change without notice.
         C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall
             not exceed .006 (0,15) per end.
         D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
         E. Reference JEDEC MS−012 variation AA.

TEXAS
INSTRUMENTS
www.ti.com

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		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Broadband	www.ti.com/broadband
DSP	dsp.ti.com	Digital Control	www.ti.com/digitalcontrol
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Military	www.ti.com/military
Logic	logic.ti.com	Optical Networking	www.ti.com/opticalnetwork
Power Mgmt	power.ti.com	Security	www.ti.com/security
Microcontrollers	microcontroller.ti.com	Telephony	www.ti.com/telephony
RFID	www.ti-rfid.com	Video & Imaging	www.ti.com/video
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

Copyright © 2009, Texas Instruments Incorporated