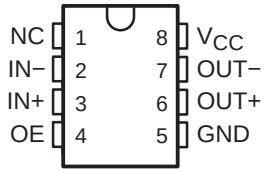
TL712
DIFFERENTIAL COMPARATOR

SLCS002D − JUNE 1983 − REVISED AUGUST 2003

- Operates From a Single 5-V Supply
- 0-V to 5.5-V Common-Mode Input Voltage Range
- Self-Biased Inputs
- Complementary 3-State Outputs
- Enable Capability
- Hysteresis . . . 5 mV Typ
- Response Times . . . 25 ns Typ

D, P, PS, OR PW PACKAGE
(TOP VIEW)



NC − No internal connection

description/ordering information

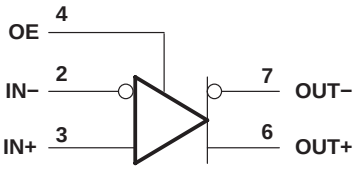
The TL712 is a high-speed comparator fabricated with bipolar Schottky process technology. The circuit has differential analog inputs and complementary 3-state TTL-compatible logic outputs with symmetrical switching characteristics. When the output enable (OE) is low, both outputs are in the high-impedance state. This device operates from a single 5-V supply and is useful as a disk memory read-chain data comparator.

ORDERING INFORMATION

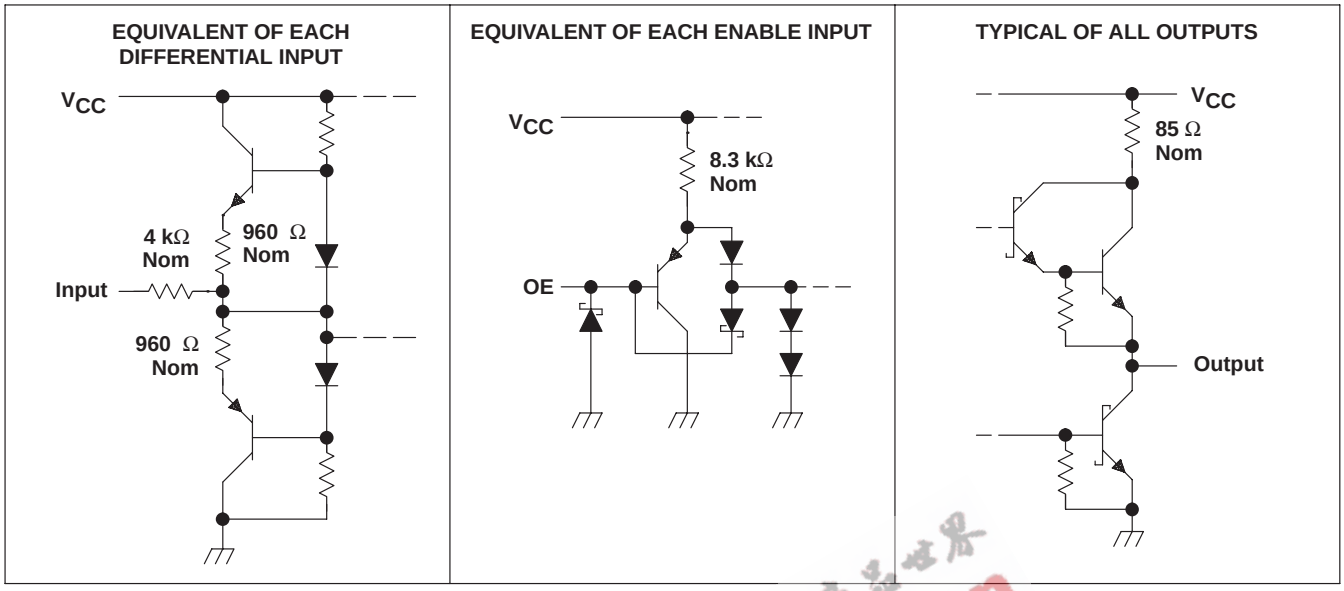
T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP (P)	Tube of 50	TL712CP	TL712CP
	SOIC (D)	Tube of 75	TL712CD	TL712C
		Reel of 2500	TL712CDR	
	SOP (PS)	Reel of 2000	TL712CPSR	T712
	TSSOP (PW)	Tube of 150	TL712CPW	T712
		Reel of 2000	TL712CPWR	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

symbol (positive logic)



schematics of inputs and outputs



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

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Differential input voltage, V_{ID} (see Note 2) . . . . . ±25 V
Input voltage, V_I, any differential input . . . . . ±25 V
Output enable voltage . . . . . 7 V
Low-level output current, I_{OL} . . . . . 50 mA
Package thermal impedance, θ_{JA} (see Notes 3 and 4): D package . . . . . 97°C/W
P package . . . . . 85°C/W
PS package . . . . . 95°C/W
PW package . . . . . 149°C/W
Operating virtual junction temperature, T_J . . . . . 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 260°C
Storage temperature range, T_{stg} . . . . . −65°C to 150°C

† 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 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.

NOTES: 1. All voltage values, except differential voltages, are with respect to the network ground.
2. Differential voltage values are at IN+ with respect to IN−.
3. Maximum power dissipation is a function of $T_J(max)$, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
4. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage	4.75	5	5.25	V
V_{IC}	Common-mode input voltage	0		5.5	V
I_{OH}	High-level output current			−1	mA
I_{OL}	Low-level output current			16	mA
T_A	Operating free-air temperature	0		70	°C

electrical characteristics at V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_T	Threshold voltage (V_{T+} and V_{T-})	V_{ICR} = 0 to 5 V		−100†		100	mV
V_{hys}	Hysteresis ($V_{T+} - V_{T-}$)				5		mV
V_{OH}	High-level output voltage	V_{ID} = 100 mV,	I_{OH} = −1 mA	2.7	3.5		V
V_{OL}	Low-level output voltage	V_{ID} = − 100 mV,	I_{OL} = 16 mA		0.4	0.5	V
I_{OZ}	Off-state output current	V_O = 2.4 V				−20	µA
I_I	Enable current	V_I = 5.5 V				100	µA
I_{IH}	High-level enable current	V_{IH} = 2.7 V				20	µA
I_{IL}	Low-level enable current	V_{IL} = 0.4 V				−360	µA
r_i	Differential input resistance			4			kΩ
r_o	Output resistance					100	Ω
I_{OS}	Short-circuit output current			−15		−85	mA
I_{CC}	Supply current	V_{ID} = 0,	No load		17	20	mA

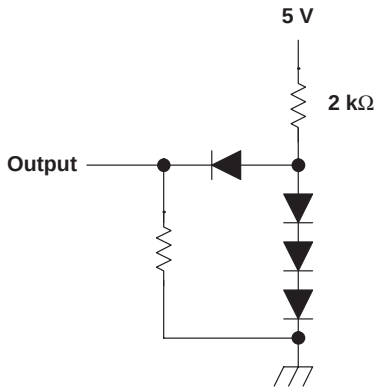
† The algebraic convention, where the more-negative limit is designated as minimum, is used in this data sheet for input threshold voltage levels only.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		TYP	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	TTL load,	See Note 5 and Figure 1	25	ns
t_{PHL}	Propagation delay time, high-to-low-level output			25	ns

NOTE 5: The response time specified is for a 100-mV input step with 5-mV overdrive (105 mV total) and is the interval between the input step function and the instant when the output crosses 2.5 V.

PARAMETER MEASUREMENT INFORMATION



NOTE A: All diodes are 1N4148 or equivalent.

Figure 1. TTL Output Load Circuit

TYPICAL CHARACTERISTICS

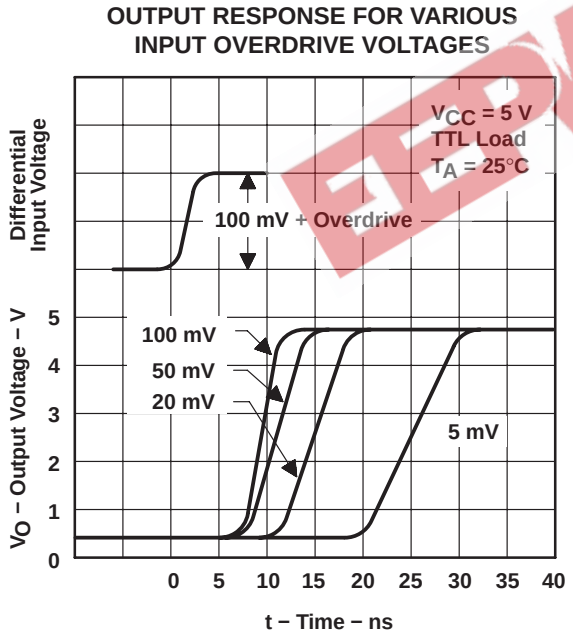


Figure 2

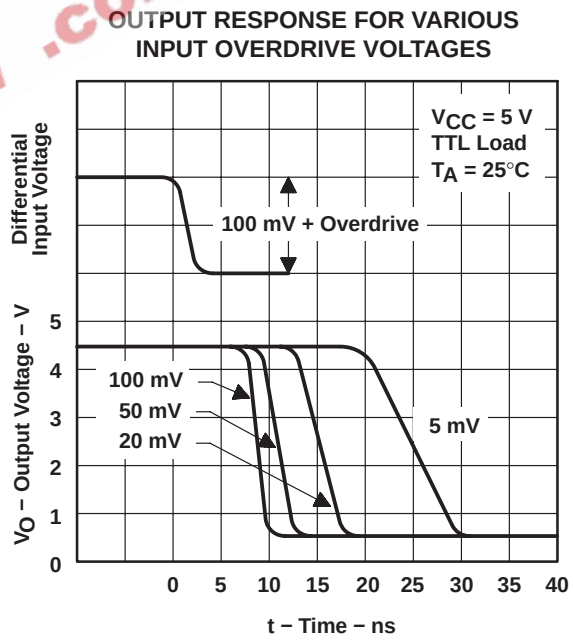


Figure 3

TYPICAL CHARACTERISTICS

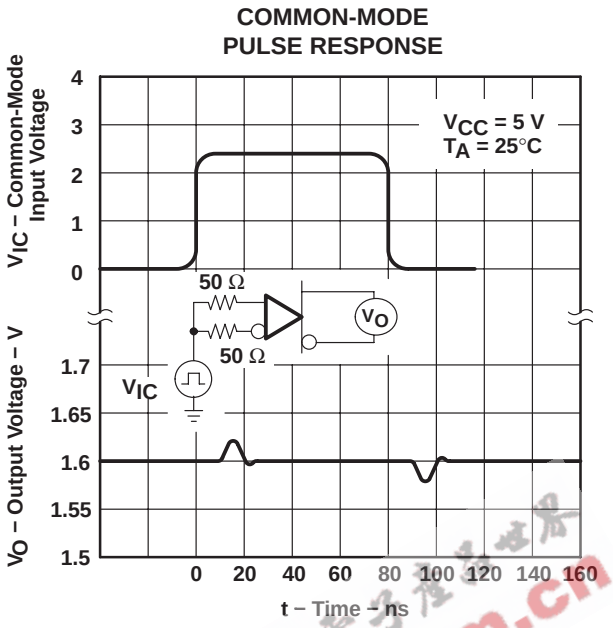


Figure 4

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
TL712CD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL712CDE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL712CDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL712CDRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL712CP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL712CPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL712CPSR	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL712CPSRE4	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL712CPW	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL712CPWE4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL712CPWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL712CPWRE4	ACTIVE	TSSOP	PW	8	2000	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.

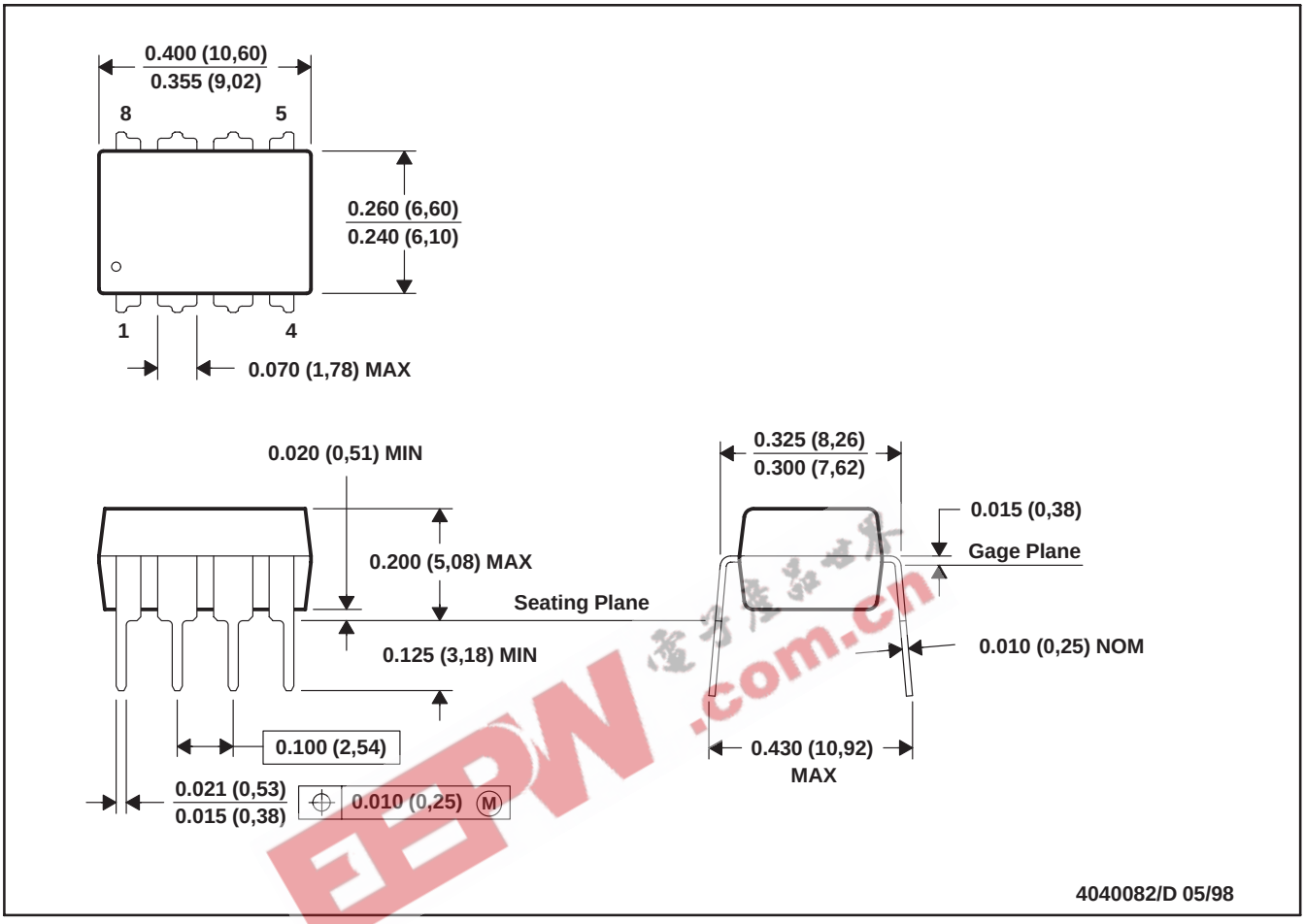
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been 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.

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.

MPDI001A – JANUARY 1995 – REVISED JUNE 1999

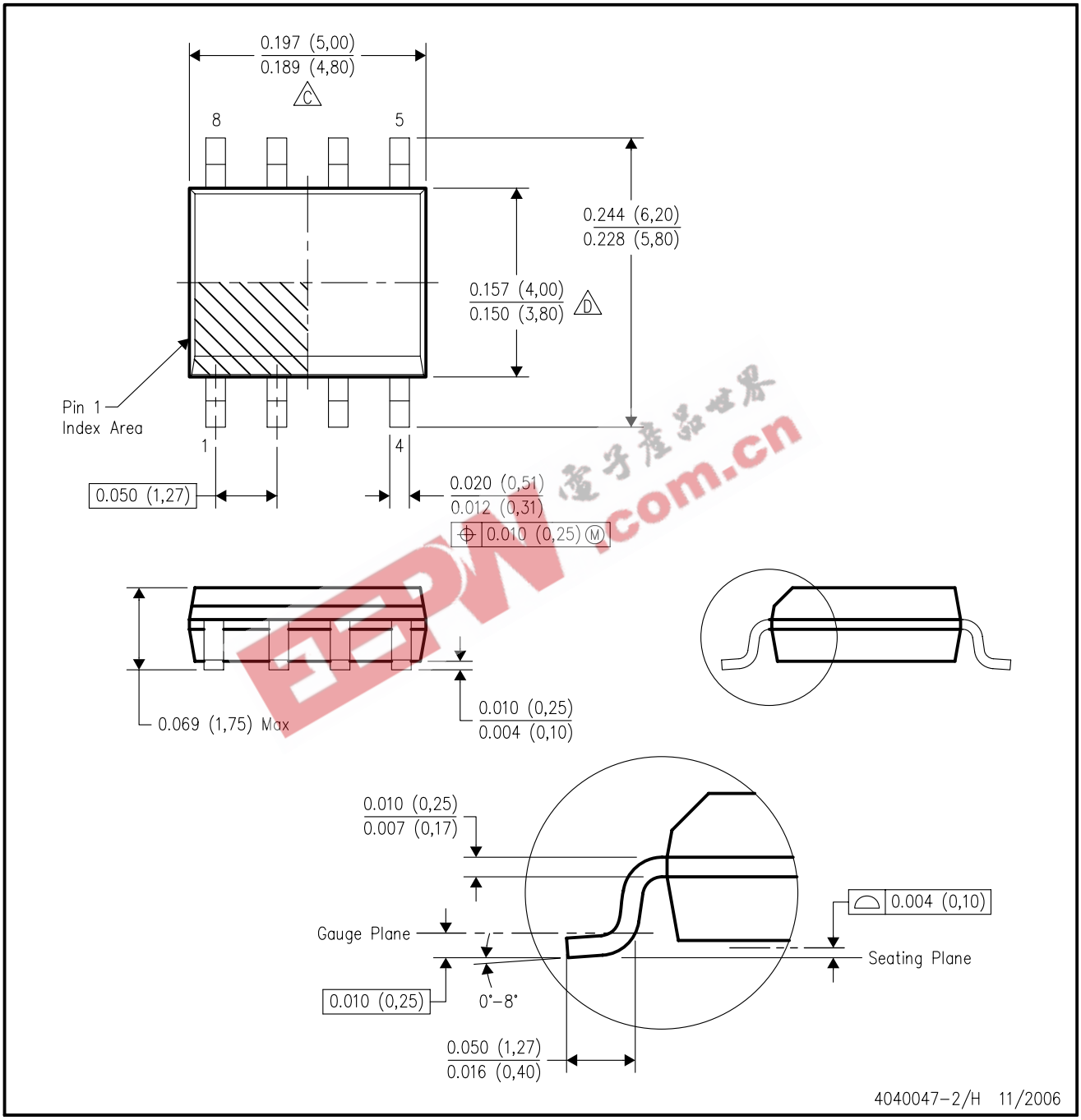
P (R-PDIP-T8) **PLASTIC DUAL-IN-LINE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001

For the latest package information, go to http://www.ti.com/sc/docs/package/pkg_info.htm

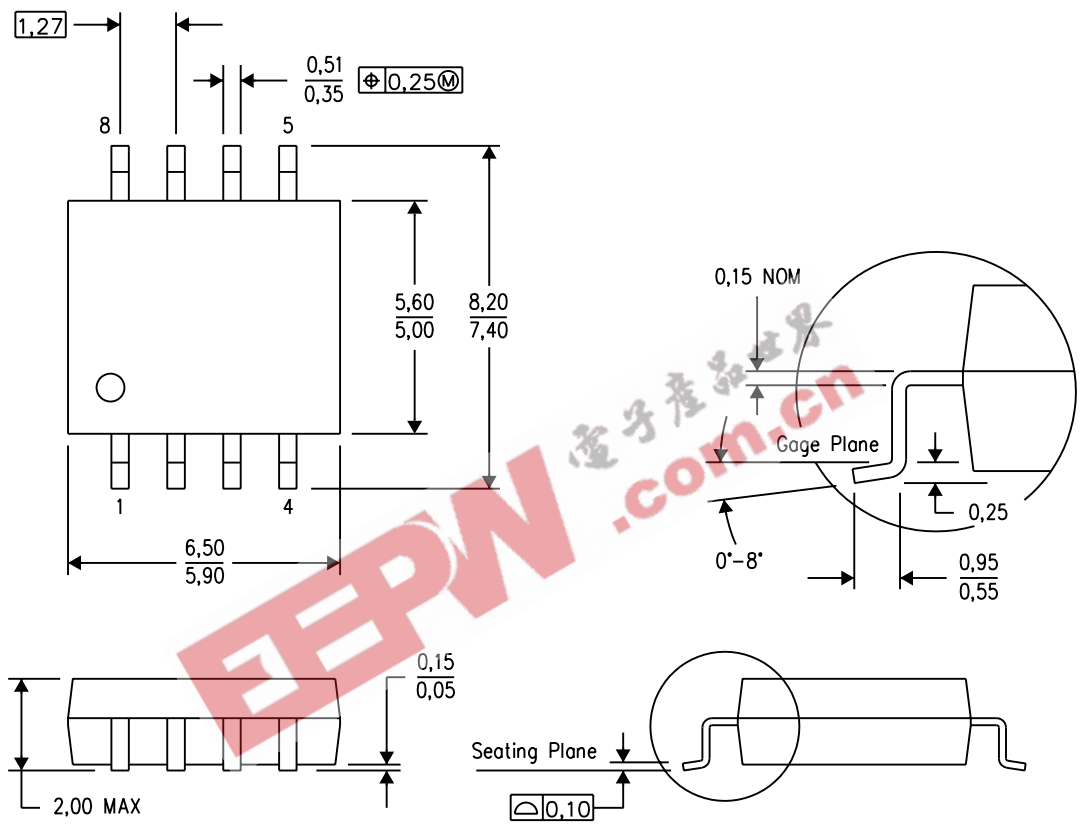
D (R–PDSO–G8) PLASTIC SMALL–OUTLINE PACKAGE



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 AA.

MECHANICAL DATA

PS (R-PDSO-G8) **PLASTIC SMALL-OUTLINE PACKAGE**



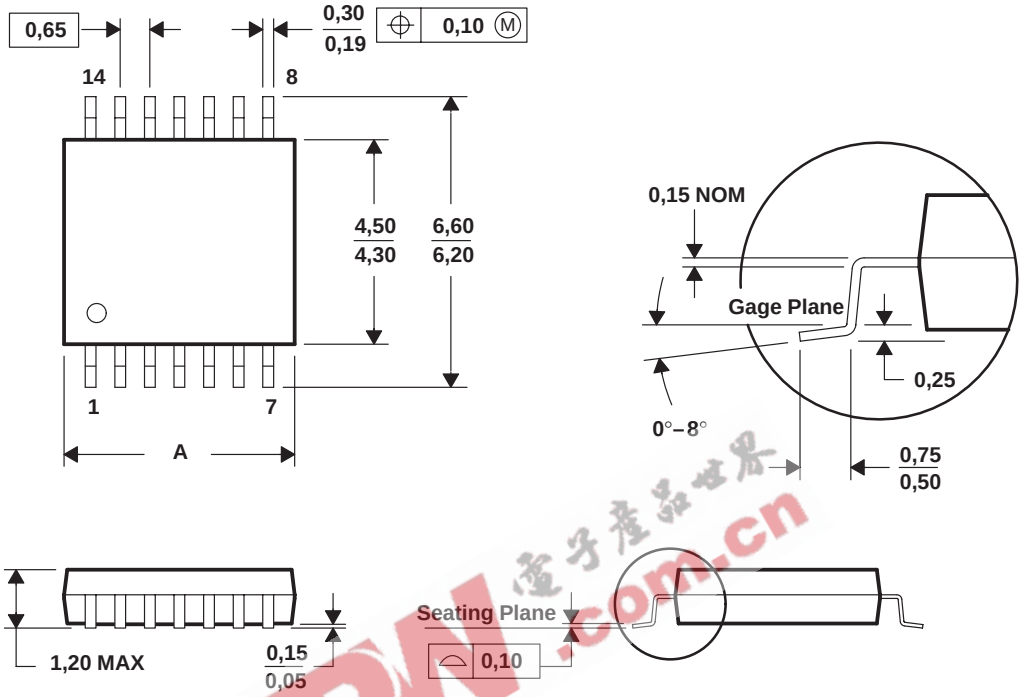
4040063/C 03/03

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

MTSS001C – JANUARY 1995 – REVISED FEBRUARY 1999

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN



DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

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 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.

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.

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
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
Low Power Wireless	www.ti.com/lpw	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