# 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

#### description/ordering information

D, P, PS, OR PW PACKAGE (TOP VIEW) NC 8 🛛 V<sub>CC</sub> IN-I 7 🛛 OUT-2 IN+∏ 6 OUT+ 3 🛛 GND

NC-No internal connection

5

OE [ 4

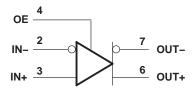
The TL712 is a high-speed comparator fabricated with bipolar Schottky process technology. The circuit has differential analog inputs and complementary 3-state TTL-compatible logic outputs with symmetrical switching characteristics. When the output enable (OE) is low, both outputs are in the high-impedance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

TA	PACK	AGET	ORDERABLE PART NUMBER	TOP-SIDE MARKING
	PDIP (P)	Tube of 50	TL712CP	TL712CP
		Tube of 75	TL712CD	TI 7400
000 10 7000	SOIC (D)	Reel of 2500	TL712CDR	TL712C
0°C to 70°C	SOP (PS)	Reel of 2000	TL712CPSR	T712
		Tube of 150	TL712CPW	T740
	TSSOP (PW)	Reel of 2000	TL712CPWR	T712

#### **ORDERING INFORMATION**

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

#### symbol (positive logic)





Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

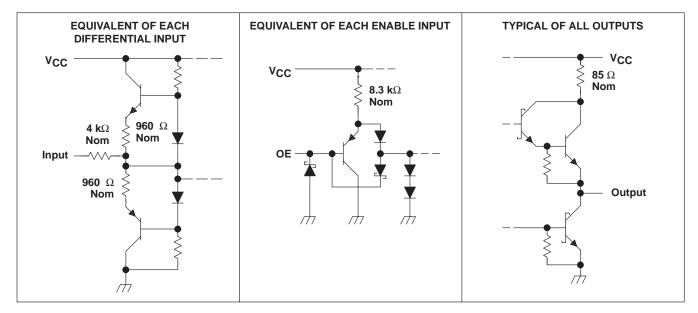


Copyright © 2003, Texas Instruments Incorporated

## TL712 DIFFERENTIAL COMPARATOR

SLCS002D - JUNE 1983 - REVISED AUGUST 2003

#### schematics of inputs and outputs



#### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Supply voltage, V <sub>CC</sub> (see Note 1)		
Differential input voltage, VID (see Note 2)		±25 V
Input voltage, V <sub>I</sub> , any differential input		±25 V
Output enable voltage		
Low-level output current, IOL		50 mA
Package thermal impedance, $\theta_{JA}$ (see Notes 3 a	nd 4): D package	
	P package	85°C/W
	PS package	
		149°C/W
Operating virtual junction temperature, T <sub>J</sub>		150°C
Lead temperature 1,6 mm (1/16 inch) from case	for 10 seconds	260°C
Storage temperature range, T <sub>stg</sub>		–65°C to 150°C

<sup>†</sup> 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<sub>J</sub>(max),  $\theta_{JA}$ , and T<sub>A</sub>. The maximum allowable power dissipation at any allowable ambient temperature is P<sub>D</sub> = (T<sub>J</sub>(max) – T<sub>A</sub>)/ $\theta_{JA}$ . Operating at the absolute maximum T<sub>J</sub> of 150°C can affect reliability.

4. The package thermal impedance is calculated in accordance with JESD 51-7.



SLCS002D - JUNE 1983 - REVISED AUGUST 2003

#### recommended operating conditions

		MIN	NOM	MAX	UNIT
VCC	Supply voltage	4.75	5	5.25	V
VIC	Common-mode input voltage	0		5.5	V
IOH	High-level output current			-1	mA
IOL	Low-level output current			16	mA
ТĄ	Operating free-air temperature	0		70	°C

# electrical characteristics at V\_{CC} = 5 V, T\_A = 25 $^\circ\text{C}$

	PARAMETER	TEST CON	MIN	TYP	MAX	UNIT	
VT	Threshold voltage (VT + and VT –)	VICR = 0 to 5 V		-100†		100	mV
V <sub>hys</sub>	Hysteresis (V <sub>T+</sub> – V <sub>T</sub> _)				5		mV
VOH	High-level output voltage	V <sub>ID</sub> = 100 mV,	I <sub>OH</sub> = -1 mA	2.7	3.5		V
VOL	Low-level output voltage	$V_{ID} = -100 \text{ mV},$	I <sub>OL</sub> = 16 mA		0.4	0.5	V
IOZ	Off-state output current	V <sub>O</sub> = 2.4 V				-20	μA
Ц	Enable current	VI = 5.5 V				100	μΑ
Iн	High-level enable current	V <sub>IH</sub> = 2.7 V				20	μΑ
١ <sub>IL</sub>	Low-level enable current	V <sub>IL</sub> = 0.4 V				-360	μΑ
rj	Differential input resistance			4			kΩ
r <sub>o</sub>	Output resistance					100	Ω
los	Short-circuit output current			-15		-85	mA
ICC	Supply current	$V_{ID} = 0,$	No load		17	20	mA

<sup>†</sup> 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	TE	TYP	UNIT	
tPLH	Propagation delay time, low-to-high-level output	TTL load.	See Note 5 and Figure 1	25	ns
<sup>t</sup> PHL	Propagation delay time, high-to-low-level output	i i ∟ 10au,	See Note 5 and Figure 1	25	ns

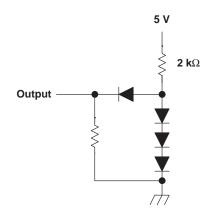
NOTE 5: The response time specified is for a 100-mV input step with 5-mV overdrive (105 mV total) and is the interval between the input step function and the instant when the output crosses 2.5 V.



## TL712 DIFFERENTIAL COMPARATOR

SLCS002D - JUNE 1983 - REVISED AUGUST 2003

### PARAMETER MEASUREMENT INFORMATION



NOTE A: All diodes are 1N4148 or equivalent.



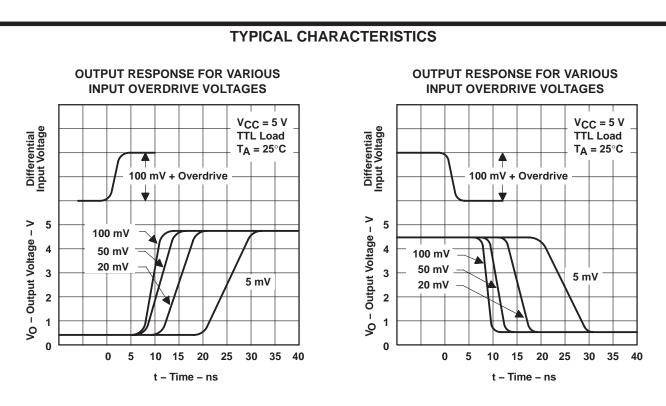
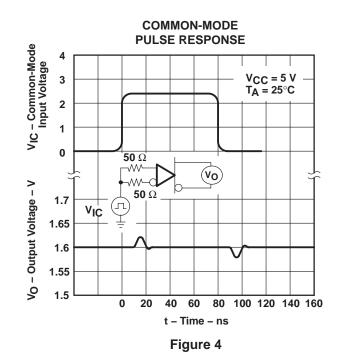




Figure 3



SLCS002D - JUNE 1983 - REVISED AUGUST 2003



#### **TYPICAL CHARACTERISTICS**



4-Jun-2007

#### **PACKAGING INFORMATION**

NTS

**FRUME** 

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	e Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
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
TL712CDG4	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
TL712CDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL712CP	ACTIVE	PDIP	Р	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL712CPE4	ACTIVE	PDIP	Р	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
TL712CPSRG4	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
TL712CPWG4	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
TL712CPWRG4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

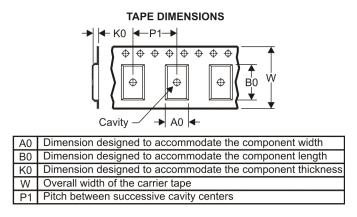
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

**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.

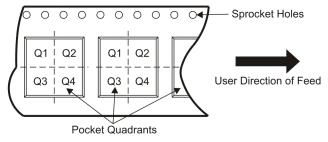
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

## TAPE AND REEL INFORMATION





## QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*A	Il dimensions are nominal												
	Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
	TL712CDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
	TL712CPSR	SO	PS	8	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
	TL712CPWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1



# PACKAGE MATERIALS INFORMATION

19-Mar-2008



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL712CDR	SOIC	D	8	2500	340.5	338.1	20.6
TL712CPSR	SO	PS	8	2000	346.0	346.0	33.0
TL712CPWR	TSSOP	PW	8	2000	346.0	346.0	29.0

P(R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



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



D (R-PDSO-G8)

PLASTIC SMALL OUTLINE

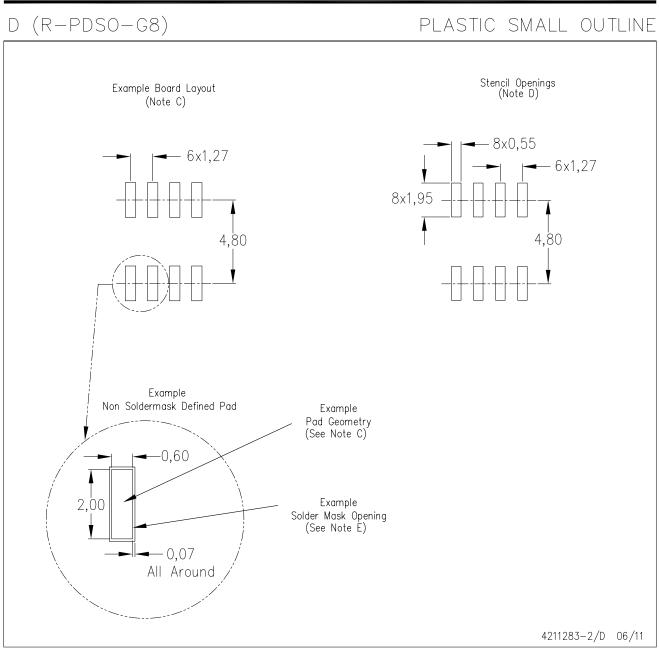


NOTES: A. All linear dimensions are in inches (millimeters).

- B. This drawing is subject to change without notice.
- 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.
- Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AA.



## LAND PATTERN DATA



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.



#### **MECHANICAL DATA**

## PS (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



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.





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.



PW (R-PDSO-G8)

PLASTIC SMALL OUTLINE



Α. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994. Ŗ. This drawing is subject to change without notice.

🖄 Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.

Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.

E. 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 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	
Audio	www.ti.com/audio	Communications and Telecom	www.ti.com/communications
Amplifiers	amplifier.ti.com	Computers and Peripherals	www.ti.com/computers
Data Converters	dataconverter.ti.com	Consumer Electronics	www.ti.com/consumer-apps
DLP® Products	www.dlp.com	Energy and Lighting	www.ti.com/energy
DSP	dsp.ti.com	Industrial	www.ti.com/industrial
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Security	www.ti.com/security
Logic	logic.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Power Mgmt	power.ti.com	Transportation and Automotive	www.ti.com/automotive
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Mobile Processors	www.ti.com/omap		
Wireless Connectivity	www.ti.com/wirelessconnectivity		
		a O a Al a a m	

**TI E2E Community Home Page** 

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2011, Texas Instruments Incorporated