SLCS015A - DECEMBER 1988 - REVISED AUGUST 2003

- Operates From a 5-V Supply
- Self-Biasing Inputs
- Hysteresis ... 10 mV Typ
- Response Time . . . 6 ns Typ
- Maximum Operating Frequency ... 50 MHz Typ

#### D OR P PACKAGE (TOP VIEW) NC 8 П V<sub>CC</sub> IN-I NC 7 2 6 OUT IN+ Г 3 NC GND 5 П Λ NC - No internal connection

### description/ordering information

The TL714C is a high-speed differential comparator fabricated with bipolar Schottky process technology. The circuit has differential inputs and a TTL-compatible logic output with symmetrical switching characteristics.

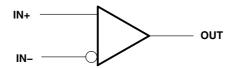
The device operates from a single 5-V supply and is useful as a disk-memory read-chain data comparator.

| T <sub>A</sub> | PACKA    | GE†          | ORDERABLE<br>PART NUMBER | TOP-SIDE<br>MARKING |  |
|----------------|----------|--------------|--------------------------|---------------------|--|
|                | PDIP (P) | Tube of 50   | TL714CP                  | TL714CP             |  |
| 0°C to 70°C    |          | Tube of 75   | TL714CD                  | TI 7440             |  |
|                | SOIC (D) | Reel of 2500 | TL714CDR                 | TL714C              |  |

### **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





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.

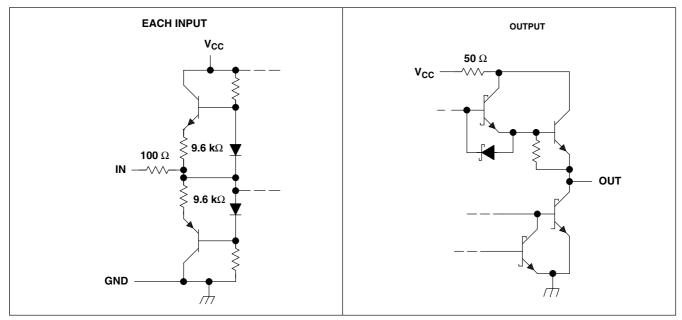
PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



Copyright © 2003, Texas Instruments Incorporated

SLCS015A - DECEMBER 1988 - REVISED AUGUST 2003

### schematic of inputs and outputs



All resistor values shown are nominal.

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

| Supply voltage, $V_{CC}$ (see Note 1)<br>Differential input voltage, $V_{ID}$ (see Note 2)<br>Input voltage range, $V_I$<br>Low-level output current, $I_{OL}$<br>Package thermal impedance, $\theta_{JA}$ (see Notes 3 and 4): D package<br>P package<br>Operating virtual junction temperature, $T_J$<br>Load temperature 1.6 mm (1/16 inch) from case for 10 seconds | ±5 V<br>V <sub>CC</sub> to GND<br>40 mA<br>97°C/W<br>85°C/W<br>150°C |
|---|--|
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds  |  |

<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 under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltage values, except differential voltage, 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  $T_J(max)$ ,  $\theta_{JA}$ , 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                               | MAX  | UNIT |
|-----------------|--------------------------------|-----------------------------------|------|------|
| V <sub>CC</sub> | Supply voltage                 | 4.75                              | 5.25 | V    |
| V <sub>IC</sub> | Common-mode input voltage      | 1.4<br>to<br>V <sub>CC</sub> -1.4 |      | v    |
| I <sub>OH</sub> | High-level output current      |                                   | -1   | mA   |
| I <sub>OL</sub> | Low-level output current       |                                   | 16   | mA   |
| T <sub>A</sub>  | Operating free-air temperature | 0                                 | 70   | °C   |



SLCS015A - DECEMBER 1988 - REVISED AUGUST 2003

# electrical characteristics over free-air operating temperature range, $V_{CC}$ = 5 V (unless otherwise noted)

|                  | PARAMETER                                       | TEST CON                         | IDITIONS                 | MIN  | TYP <sup>†</sup> | MAX  | UNIT |
|------------------|---|----------------------------------|--------------------------|------|------------------|------|------|
| $V_{T}$          | Threshold voltage ( $V_{T+}$ and $V_{T-}$ )     | $V_{IC} = 1.4 V \text{ to } 3.6$ | 6 V                      | -75‡ |                  | 75   | mV   |
| V <sub>hys</sub> | Hysteresis (V <sub>T+</sub> – V <sub>T-</sub> ) |                                  |                          | 2    | 10               | 30   | mV   |
| V <sub>OH</sub>  | High-level output voltage                       | V <sub>ID</sub> = 100 mV,        | $I_{OH} = -1 \text{ mA}$ | 2.7  | 3.4              |      | V    |
| V <sub>OL</sub>  | Low-level output voltage                        | $V_{ID} = -100 \text{ mV},$      | I <sub>OL</sub> = 16 mA  |      | 0.4              | 0.5  | V    |
| I <sub>OS</sub>  | Short-circuit output current                    |                                  |                          | -30  |                  | -110 | mA   |
| r <sub>i</sub>   | Differential input resistance                   |                                  |                          | 2.9  |                  |      | kΩ   |
| I <sub>CC</sub>  | Supply current                                  | $V_{ID} = -100 \text{ mV},$      | I <sub>O</sub> = 0       |      | 7                | 12   | mA   |

 $^{\dagger}$  All typical values are at  $T_{A}$  = 25°C.

<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, $V_{CC} = 5 V$ , $T_A = 25^{\circ}C$

|                  | PARAMETER  | TEST C   | MIN   | TYP <sup>†</sup> | MAX | UNIT |     |
|------------------|--|--|---|------------------|-----|------|-----|
| f <sub>max</sub> | Maximum operating frequency                      | $V_{ID} = \pm 250 \text{ mV},$<br>$C_L = 25 \text{ pF},$ | $t_r = t_f = 4 \text{ ns},$<br>Input duty cycle = 50% |                  | 50  |      | MHz |
| t <sub>PLH</sub> | Propagation delay time, low-to-high-level output | V <sub>ID</sub> = ±100 mV,                               | C <sub>L</sub> = 25 pF,                               |                  | 6   | 12   | ns  |
| t <sub>PHL</sub> | Propagation delay time, high-to-low-level output | See Figures 1 and 2                                      |   |                  | 6   | 12   | ns  |
| t <sub>r</sub>   | Rise time  | V <sub>ID</sub> = ±100 mV,                               | C <sub>L</sub> = 25 pF,                               |                  | 4   | 8    | ns  |
| t <sub>f</sub>   | Fall time  | See Figure 3   |   |                  | 4   | 8    | ns  |

<sup>†</sup> All typical values are at  $T_A = 25^{\circ}C$ .

### PARAMETER MEASUREMENT INFORMATION

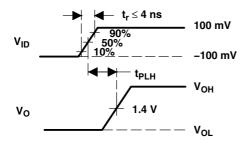


Figure 1. Propagation Delay Time, Low to High (t<sub>PLH</sub>)

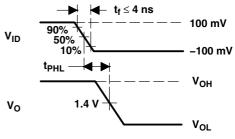
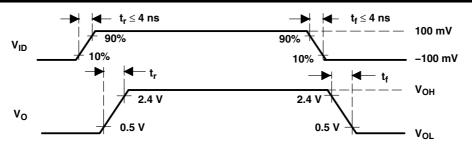


Figure 2. Propagation Delay Time, High to Low (t<sub>PHL</sub>)



SLCS015A - DECEMBER 1988 - REVISED AUGUST 2003







### PACKAGING INFORMATION

| Orderable Device | Status <sup>(1)</sup> | Package<br>Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan <sup>(2)</sup>    | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|-----------------|--------------------|------|----------------|----------------------------|------------------|------------------------------|
| TL714CD          | ACTIVE                | SOIC            | D                  | 8    | 75             | Green (RoHS & no Sb/Br)    | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL714CDE4        | ACTIVE                | SOIC            | D                  | 8    | 75             | Green (RoHS &<br>no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL714CDG4        | ACTIVE                | SOIC            | D                  | 8    | 75             | Green (RoHS & no Sb/Br)    | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL714CDR         | ACTIVE                | SOIC            | D                  | 8    | 2500           | Green (RoHS &<br>no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL714CDRE4       | ACTIVE                | SOIC            | D                  | 8    | 2500           | Green (RoHS & no Sb/Br)    | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL714CDRG4       | ACTIVE                | SOIC            | D                  | 8    | 2500           | Green (RoHS &<br>no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL714CP          | ACTIVE                | PDIP            | Р                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| TL714CPE4        | ACTIVE                | PDIP            | Р                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU        | N / A for Pkg Type           |

<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.

(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)

<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



| *All | dimensions | are | nominal |
|------|------------|-----|---------|
|------|------------|-----|---------|

| Device   |      | Package<br>Drawing |   |      | Reel<br>Diameter<br>(mm) | Reel<br>Width<br>W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1<br>(mm) | W<br>(mm) | Pin1<br>Quadrant |
|----------|------|--------------------|---|------|--------------------------|--------------------------|---------|---------|---------|------------|-----------|------------------|
| TL714CDR | SOIC | D                  | 8 | 2500 | 330.0                    | 12.4                     | 6.4     | 5.2     | 2.1     | 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) |
|----------|--------------|-----------------|------|------|-------------|------------|-------------|
| TL714CDR | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |

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.



### **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<br>Automotive | www.ti.com/automotive             |
| Microcontrollers            | microcontroller.ti.com | Video and Imaging                | www.ti.com/video                  |
| RFID                        | www.ti-rfid.com        | Wireless                         | www.ti.com/wireless-apps          |
| RF/IF and ZigBee® Solutions | www.ti.com/lprf        |                                  |                                   |

**TI E2E Community Home Page** 

e2e.ti.com

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