

### **Rochester Electronics Manufactured Components**

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All recreations are done with the approval of the OCM.

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceed the OCM data sheet.

### **Quality Overview**

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-35835
  - Class Q Military
  - Class V Space Level
- Qualified Suppliers List of Distributors (QSLD)
  - Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OEM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

# Am29C827/Am29C828 Am29C927/Am29C928

High-Performance CMOS Bus Buffers

Am29C827/Am29C828  
Am29C927/Am29C928

## DISTINCTIVE CHARACTERISTICS

- High-speed CMOS buffers and inverters
  - D-Y delay = 7 ns typical
- Low standby power
- JEDEC FCT-compatible specs
- $I_{OL} = 24$  mA, Commercial and Military
- 200-mV typical hysteresis on data input ports
- Am29C900 DIP pinout option reduces lead inductance on  $V_{CC}$  and GND pins

## GENERAL DESCRIPTION

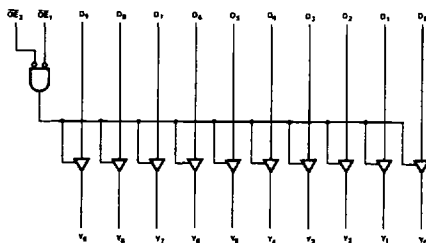
The Am29C827 and Am29C828 CMOS Bus Buffers provide high-performance bus interface buffering for wide address/data paths or buses carrying parity. Both devices feature 10-bit wide data paths and NORed output enables for maximum control flexibility. The Am29C827 has non-inverting outputs, while the Am29C828 has inverting outputs. Each device has data inputs with 200-mV typical input hysteresis to provide improved noise immunity. The Am29C827 and Am29C828 are produced with AMD's exclusive CS-11 CMOS process, and feature typical propa-

gation delays of 7 ns, as well as an output current drive of 24 mA.

The Am29C827 and Am29C828 are available in the standard package options: DIPs, PLCCs, LCCs, SOICs, and Flatpacks. In addition, a DIP pinout option, featuring center  $V_{CC}$  and GND pins, reduces the lead inductance of the  $V_{CC}$  and GND pins. The ordering part numbers for CMOS buffers with this pinout are the Am29C927 and Am29C928; their pinouts are shown later in this data sheet.

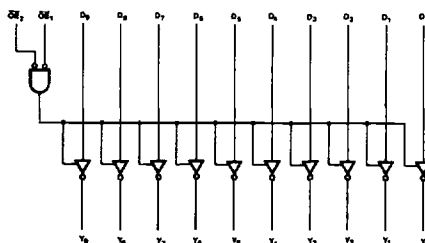
## BLOCK DIAGRAMS

### Am29C827 (Noninverting)



BD001092

### Am29C828 (Inverting)

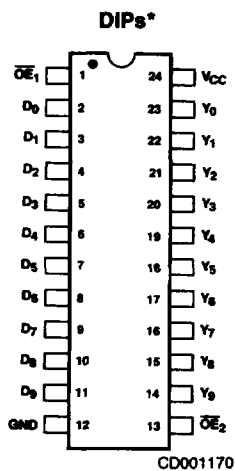


BD001093

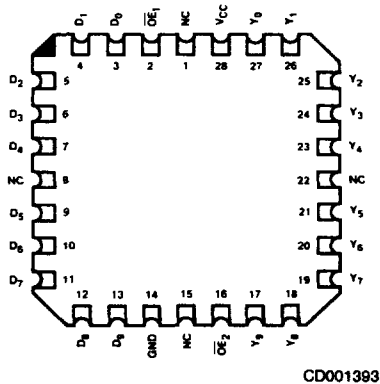
| Publication #            | Rev. | Amendment |
|--------------------------|------|-----------|
| 05308                    | C    | /0        |
| Issue Date: January 1988 |      |           |

## CONNECTION DIAGRAMS Top View

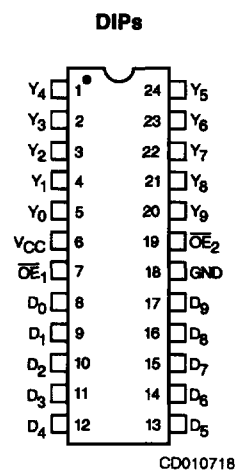
**Am29C827/Am29C828**



**LCC\*\***



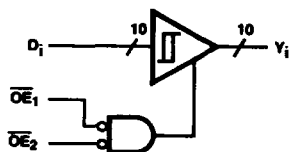
**Am29C927/  
Am29C928**



\*Also available in 24-Pin Flatpack and Small Outline packages; pinout identical to DIPs.  
\*\*Also available in 28-Pin PLCC; pinout identical to LCC.

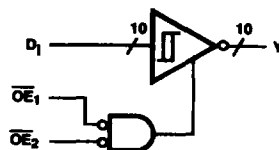
## LOGIC SYMBOLS

**Am29C827**



LS000391

**Am29C828**



LS000383

## FUNCTION TABLES

**Am29C827**

| Inputs          |                 |                | Outputs        |  | Function    |
|-----------------|-----------------|----------------|----------------|--|-------------|
| OE <sub>1</sub> | OE <sub>2</sub> | D <sub>1</sub> | Y <sub>1</sub> |  |             |
| L               | L               | H              | H              |  | Transparent |
| L               | L               | L              | L              |  | Transparent |
| X               | H               | X              | Z              |  | Hi-Z        |
| H               | X               | X              | Z              |  | Hi-Z        |

**Am29C828**

| Inputs          |                 |                | Outputs        |  | Function    |
|-----------------|-----------------|----------------|----------------|--|-------------|
| OE <sub>1</sub> | OE <sub>2</sub> | D <sub>1</sub> | Y <sub>1</sub> |  |             |
| L               | L               | H              | L              |  | Transparent |
| L               | L               | L              | H              |  | Transparent |
| X               | H               | X              | Z              |  | Hi-Z        |
| H               | X               | X              | Z              |  | Hi-Z        |

H = HIGH  
L = LOW  
X = Don't Care  
Z = Hi-Z

## ORDERING INFORMATION Standard Products

AMD products are available in several packages and operating ranges. The order number (Valid Combination) is formed by a combination of:

- a. **Device Number**
- b. **Speed Option** (if applicable)
- c. **Package Type**
- d. **Temperature Range**
- e. **Optional Processing**

AM29C827

P

C

B

**e. OPTIONAL PROCESSING**  
Blank = Standard processing  
B = Burn-in

**d. TEMPERATURE RANGE**  
C = Commercial (0 to +70°C)  
E = Extended Commercial (-55 to +125°C)

**c. PACKAGE TYPE**  
P = 24-Pin Slim Plastic DIP (PD3024)  
D = 24-Pin Slim Ceramic DIP (CD3024)  
S = 24-Pin Plastic Small Outline Package (SO 024)  
J = 28-Pin Plastic Leaded Chip Carrier (PL 028)  
L = 28-Pin Ceramic Leadless Chip Carrier (CL 028)

**b. SPEED OPTION**  
Not Applicable

**a. DEVICE NUMBER/DESCRIPTION**  
Am29C827 CMOS 10-Bit Noninverting Buffer  
Am29C828 CMOS 10-Bit Inverting Buffer  
Am29C927 CMOS 10-Bit Noninverting Buffer (Center-V<sub>CC</sub>-and-GND Pinout)  
Am29C928 CMOS 10-Bit Inverting Buffer (Center-V<sub>CC</sub>-and-GND Pinout)

| Valid Combinations |                   |
|--------------------|-------------------|
| AM29C827           | PC, PCB, DC, DCB, |
| AM29C828           | DE, SC, JC, LC    |
| AM29C927           | PC, PCB, DC, DCB, |
| AM29C928           | DE                |

### Valid Combinations

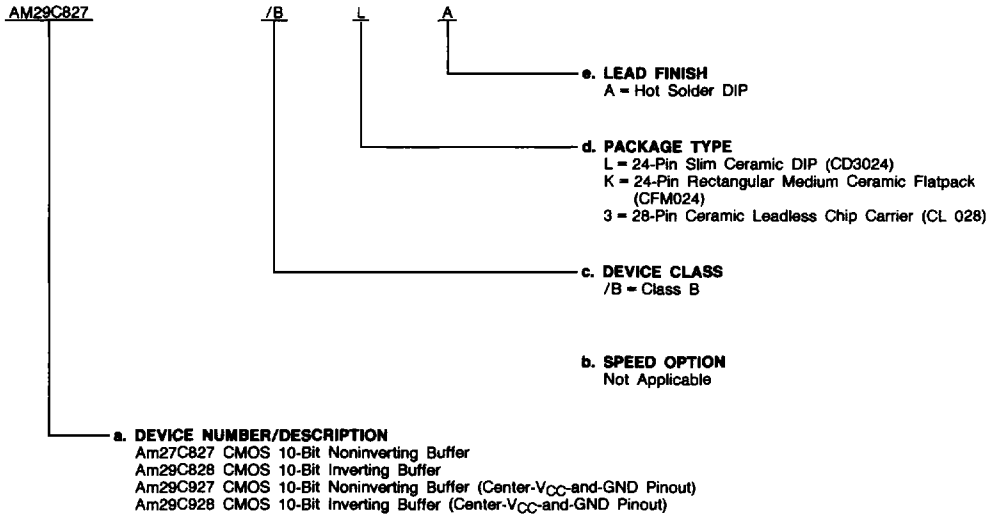
Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations, to check on newly released valid combinations, and to obtain additional data on AMD's standard military grade products.

## ORDERING INFORMATION (Cont'd.)

### APL Products

AMD products for Aerospace and Defense applications are available in several packages and operating ranges. APL (Approved Products List) products are fully compliant with MIL-STD-883C requirements. The order number (Valid Combination) for APL products is formed by a combination of:

- a. Device Number
- b. Speed Option (if applicable)
- c. Device Class
- d. Package Type
- e. Lead Finish



| Valid Combinations |                  |
|--------------------|------------------|
| AM29C827           | /BLA, /BKA, /B3A |
| AM29C828           |                  |
| AM29C927           | /BLA             |
| AM29C928           |                  |

#### Valid Combinations

Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations or to check for newly released valid combinations.

#### Group A Tests

Group A tests consist of Subgroups  
 1, 2, 3, 7, 8, 9, 10, 11.

## PIN DESCRIPTION

### $\overline{OE}_1$ Output Enables (Input, Active LOW)

When  $\overline{OE}_1$  and  $\overline{OE}_2$  are both LOW, the outputs are enabled. When either one or both are HIGH, the outputs are in the Hi-Z state.

### $D_i$ Data Inputs (Input)

$D_i$  are the 10-bit data inputs.

### $Y_i$ Data Output (Output)

$Y_i$  are the 10-bit data outputs.

### ABSOLUTE MAXIMUM RATINGS

|  |                              |
|--|------------------------------|
| Storage Temperature .....  | -65 to +150°C                |
| Supply Voltage to Ground Potential   |                              |
| Continuous .....   | -0.5 V to +7.0 V             |
| DC Output Voltage .....  | -0.5 V to $V_{CC} + 0.5$ V   |
| DC Input Voltage .....   | -0.5 V to $V_{CC} + 0.5$ V   |
| DC Output Diode Current: Into Output .....                                     | +50 mA                       |
| Out of Output .....  | -50 mA                       |
| DC Input Diode Current: Into Input .....                                       | +20 mA                       |
| Out of Input .....   | -20 mA                       |
| DC Output Current per Pin:   |                              |
| $I_{SINK}$ .....   | +48 mA ( $2 \times I_{OL}$ ) |
| $I_{SOURCE}$ .....   | -30 mA ( $2 \times I_{OH}$ ) |
| Total DC Ground Current ( $n \times I_{OL} + m \times I_{CCT}$ ) mA (Note 1)   |                              |
| Total DC $V_{CC}$ Current ( $n \times I_{OH} + m \times I_{CCT}$ ) mA (Note 1) |                              |

Stresses above those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

### OPERATING RANGES

|  |                  |
|--|------------------|
| Commercial (C) Devices                           |                  |
| Temperature ( $T_A$ ) .....                      | 0 to +70°C       |
| Supply Voltage ( $V_{CC}$ ) .....                | +4.5 V to +5.5 V |
| Military (M) and Extended Commercial (E) Devices |                  |
| Temperature ( $T_A$ ) .....                      | -55 to +125°C    |
| Supply Voltage ( $V_{CC}$ ) .....                | +4.5 V to +5.5 V |

Operating ranges define those limits between which the functionality of the device is guaranteed.

**DC CHARACTERISTICS** over operating range unless otherwise specified (for APL Products, Group A, Subgroups 1, 2, 3 are tested unless otherwise noted)

| Parameter Symbol  | Parameter Description                     | Test Conditions   |                             | Min.             | Max.       | Units           |
|-------------------|---|---|-----------------------------|------------------|------------|-----------------|
| $V_{OH}$          | Output HIGH Voltage                       | $V_{CC} = 4.5$ V<br>$V_{IN} = V_{IH}$ or $V_{IL}$             | $I_{OH} = -15$ mA           | 2.4              |            | Volts           |
| $V_{OL}$          | Output LOW Voltage                        | $V_{CC} = 4.5$ V<br>$V_{IN} = V_{IH}$ or $V_{IL}$             | $I_{OL} = 24$ mA            |                  | 0.5        | Volts           |
| $V_{IH}$          | Input HIGH Voltage                        | Guaranteed Input Logical HIGH Voltage for All Inputs (Note 2) |                             | 2.0              |            | Volts           |
| $V_{IL}$          | Input LOW Voltage                         | Guaranteed Input Logical LOW Voltage for All Inputs (Note 2)  |                             |                  | 0.8        | Volts           |
| $V_I$             | Input Clamp Voltage                       | $V_{CC} = 4.5$ V, $I_{IN} = -18$ mA                           |                             |                  | -1.2       | Volts           |
| $I_{IL}$          | Input LOW Current                         | $V_{CC} = 5.5$ V, $V_{IN} = GND$                              |                             |                  | -10        | $\mu$ A         |
|                   |   | $V_{CC} = 5.5$ V, $V_{IN} = 0.4$ V                            |                             |                  | -5         |                 |
| $I_{IH}$          | Input HIGH Current                        | $V_{CC} = 5.5$ V, $V_{IN} = 2.7$ V                            |                             |                  | 5          | $\mu$ A         |
|                   |   | $V_{CC} = 5.5$ V, $V_{IN} = 5.5$ V                            |                             |                  | 10         |                 |
| $I_{OZH}$         | Output Off-State Current (High Impedance) | $V_{CC} = 5.5$ V, $V_O = 5.5$ V or 2.7 V (Note 3)             |                             |                  | +10        | $\mu$ A         |
| $I_{OZL}$         |   | $V_{CC} = 5.5$ V, $V_O = 0.4$ V or GND (Note 3)               |                             |                  | -10        | $\mu$ A         |
| $I_{SC}$          | Output Short-Circuit Current              | $V_{CC} = 5.5$ V, $V_O = 0$ V (Note 4)                        |                             | -60              |            | mA              |
| $I_{CCQ}$         | Static Supply Current                     | $V_{CC} = 5.5$ V<br>Outputs Open                              | $V_{IN} = V_{CC}$<br>or GND | MIL              | 160        | $\mu$ A         |
| $I_{CCT}$         |   |   |                             | COM'L            | 120        |                 |
|                   |   |   |                             | $V_{IN} = 3.4$ V | Data Input | 1.5             |
|                   |   | $\overline{OE}_1, \overline{OE}_2$                            | 3.0                         |                  |            |                 |
| $I_{CCD}^\dagger$ | Dynamic Supply Current                    | $V_{CC} = 5.5$ V (Note 5)                                     |                             |                  | 275        | $\mu$ A/MHz/Bit |

- Notes:** 1.  $n$  = number of outputs,  $m$  = number of inputs.  
 2. Input thresholds are tested in combination with other DC parameters or by correlation.  
 3. Off-state currents are only tested at worst-case conditions of  $V_{OUT} = 5.5$  V or 0.0 V.  
 4. Not more than one output should be shorted at a time. Duration should not exceed 100 milliseconds.  
 5. Measured at a frequency  $\leq 10$  MHz with 50% duty cycle.

$^\dagger$  Not included in Group A tests.

**SWITCHING CHARACTERISTICS** over operating range unless otherwise specified (for APL Products, Group A, Subgroups 9, 10, 11 are tested unless otherwise noted)

| Parameter Symbol | Parameter Description   | Test Conditions*   | COMMERCIAL |      | MILITARY |      | Units |    |
|------------------|---|--|------------|------|----------|------|-------|----|
|                  |   |  | Min.       | Max. | Min.     | Max. |       |    |
| t <sub>PLH</sub> | Data (D <sub>i</sub> ) to Output (Y <sub>i</sub> )<br>Am29C827 (Noninverting) | C <sub>L</sub> = 50 pF<br>R <sub>1</sub> = 500 Ω<br>R <sub>2</sub> = 500 Ω |            | 10   |          | 12   | ns    |    |
| t <sub>PHL</sub> |   |  |            | 10   |          | 12   | ns    |    |
| t <sub>PLH</sub> | Data (D <sub>i</sub> ) to Output (Y <sub>i</sub> )<br>Am29C828 (Inverting)    |  |            | 10   |          | 12   | ns    |    |
| t <sub>PHL</sub> |   |  |            | 10   |          | 12   | ns    |    |
| t <sub>ZH</sub>  | Output Enable Time $\overline{OE}$ to Y <sub>i</sub>                          |  |            |      | 13       |      | 15    | ns |
| t <sub>ZL</sub>  |   |  |            |      | 13       |      | 15    | ns |
| t <sub>HZ</sub>  | Output Disable Time $\overline{OE}$ to Y <sub>i</sub>                         |  |            |      | 13       |      | 15    | ns |
| t <sub>LZ</sub>  |   |  |            |      | 13       |      | 15    | ns |

\*See Test Circuit and Waveforms.