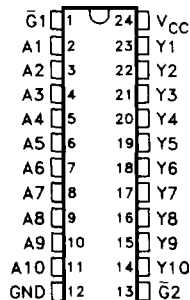


# SN74BCT2827A, SN74BCT2828A 10-BIT BUS/MOS MEMORY DRIVERS WITH 3-STATE OUTPUTS

D2977, APRIL 1987—REVISED AUGUST 1988

- BICMOS Design Substantially Reduces Standby Current
- 25-Ω Series Resistors at Outputs Significantly Reduce Overshoot and Undershoot
- Specifically Designed to Drive MOS DRAMs
- 3-State Outputs
- Data Flow-Thru Pinout (All Inputs on Opposite Side from Outputs)
- Power-Up High-Impedance State
- Package Options Include Plastic "Small Outline" Packages and Standard Plastic DIPs

DW OR NT PACKAGE  
(TOP VIEW)



## description

These 10-bit buffers and bus drivers are specifically designed to drive the capacitive input characteristics of MOS DRAMs. They provide high-performance bus interface for wide data paths or buses carrying parity.

The three-state control gate is a 2-input positive NOR gate so if either  $\bar{G}1$  or  $\bar{G}2$  is high, all 10 outputs are in the high-impedance state. The outputs are also in the high-impedance state during power-up and power-down conditions. The outputs remain in the high-impedance state while the device is powered-down.

The SN74BCT2827A provides true data and the SN74BCT2828A provides inverted data at the outputs.

These devices are characterized for operation from 0°C to 70°C.

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BICMOS Circuits

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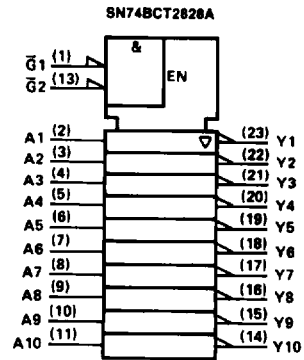
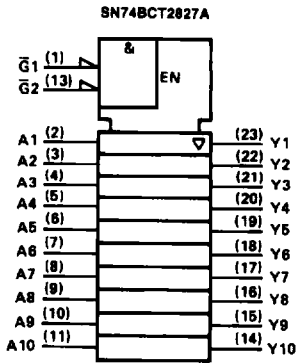
TEXAS  
INSTRUMENTS

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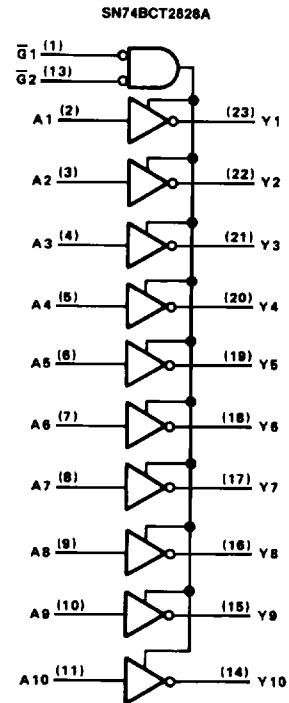
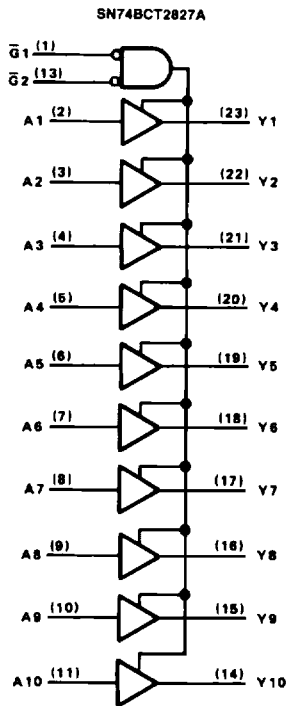
**SN74BCT2827A, SN74BCT2828A**  
**10-BIT BUS/MOS MEMORY DRIVERS WITH 3-STATE OUTPUTS**

logic symbols†



†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagrams (positive logic)



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**BICMOS Circuits**

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

Supply voltage, $V_{CC}$ .....	7 V
Input voltage .....	5.5 V
Voltage applied to a disabled 3-state output .....	5.5 V
Operating free-air temperature range .....	0°C to 70°C
Storage temperature range .....	-65°C to 150°C

**recommended operating conditions**

	MIN	NOM	MAX	UNIT
$V_{CC}$ Supply voltage	4.5	5	5.5	V
$V_{IH}$ High-level input voltage	2			V
$V_{IL}$ Low-level input voltage			0.8	V
$I_{OH}$ High-level output current			-1	mA
$I_{OL}$ Low-level output current			12	mA
$T_A$ Operating free-air temperature	0		70	°C

**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$V_{IL}$	$V_{CC} = 4.5 V$ , $I_I = -18 mA$			-1.2	V
$V_{OH}$	$V_{CC} = 4.5 V$ to $5.5 V$ , $I_{OH} = -1 mA$	$V_{CC} - 2$			V
$V_{OL}$	$V_{CC} = 4.5 V$ , $I_{OL} = 1 mA$		0.15	0.5	V
	$V_{CC} = 4.5 V$ , $I_{OL} = 12 mA$		0.35	0.8	V
$I_{OZH}$	$V_{CC} = 5.5 V$ , $V_O = 2.7 V$			20	μA
$I_{OZL}$	$V_{CC} = 5.5 V$ , $V_O = 0.4 V$			-20	μA
$I_{OL}$	$V_{CC} = 4.5 V$ , $V_O = 2 V$	50			mA
$I_{OH}$	$V_{CC} = 4.5 V$ , $V_O = 2 V$	-35			mA
$I_I$	$V_{CC} = 5.5 V$ , $V_I = 7 V$			0.1	mA
$I_{IH}$	$V_{CC} = 5.5 V$ , $V_I = 2.7 V$			20	μA
$I_{IL}$	$V_{CC} = 5.5 V$ , $V_I = 0.4 V$			-0.2	mA
$I_{O}^{\ddagger}$	$V_{CC} = 5.5 V$ , $V_O = 2.25 V$	-30		-112	mA
$I_{CCL}$	$V_{CC} = 5.5 V$ , Outputs open		28	40	mA
$I_{CCZ}$	$V_{CC} = 5.5 V$ , Outputs open		4.5	8	mA

† All typical values are at  $V_{CC} = 5 V$ ,  $T_A = 25^\circ C$ .

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

**switching characteristics (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5 V$ , $C_L = 50 pF$ , $R_1 = 500 \Omega$ , $R_2 = 500 \Omega$ , $T_A = 25^\circ C$			$V_{CC} = 4.5 V$ to $5.5 V$ , $C_L = 50 pF$ , $R_1 = 500 \Omega$ , $R_2 = 500 \Omega$ , $T_A = \text{MIN to MAX}$		UNIT
			MIN	TYP	MAX	MIN	MAX	
$t_{PLH}$	A	Y		4	6	2	7	ns
$t_{PHL}$				6	8	2	9	
$t_{PZH}$	$\bar{G}$	Y		8	10	4	13	ns
$t_{PZL}$				11	14	6	17	
$t_{PHZ}$	$\bar{G}$	Y		8	12	4	15	ns
$t_{PLZ}$				7	11	3	13	

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BICMOS Circuits



**SN74BCT2828A**  
**10-BIT BUS/MOS MEMORY DRIVERS WITH 3-STATE OUTPUTS**

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

Supply voltage, $V_{CC}$ .....	7 V
Input voltage .....	5.5 V
Voltage applied to a disabled 3-state output .....	5.5 V
Operating free-air temperature range .....	0°C to 70°C
Storage temperature range .....	-65°C to 150°C

**recommended operating conditions**

	MIN	NOM	MAX	UNIT
$V_{CC}$ Supply voltage	4.5	5	5.5	V
$V_{IH}$ High-level input voltage	2			V
$V_{IL}$ Low-level input voltage			0.8	V
$I_{OH}$ High-level output current			-1	mA
$I_{OL}$ Low-level output current			12	mA
$T_A$ Operating free-air temperature	0		70	°C

**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$V_{IK}$	$V_{CC} = 4.5 V, I_I = -18 mA$			-1.2	V
$V_{OH}$	$V_{CC} = 4.5 V$ to 5.5 V, $I_{OH} = -1 mA$	$V_{CC} - 2$			V
$V_{OL}$	$V_{CC} = 4.5 V, I_{OL} = 1 mA$		0.15	0.5	V
	$V_{CC} = 4.5 V, I_{OL} = 12 mA$		0.35	0.8	
$I_{OZH}$	$V_{CC} = 5.5 V, V_O = 2.7 V$			20	μA
$I_{OZL}$	$V_{CC} = 5.5 V, V_O = 0.4 V$			-20	μA
$I_{OL}$	$V_{CC} = 4.5 V, V_O = 2 V$	50			mA
$I_{OH}$	$V_{CC} = 4.5 V, V_O = 2 V$	-35			mA
$I_I$	$V_{CC} = 5.5 V, V_I = 7 V$			0.1	mA
$I_{IH}$	$V_{CC} = 5.5 V, V_I = 2.7 V$			20	μA
$I_{IL}$	$V_{CC} = 5.5 V, V_I = 0.4 V$			-0.2	mA
$I_O^{\ddagger}$	$V_{CC} = 5.5 V, V_O = 2.25 V$	-30		-112	mA
$I_{OCL}$	$V_{CC} = 5.5 V, \text{Outputs open}$		28	40	mA
$I_{CCZ}$	$V_{CC} = 5.5 V, \text{Outputs open}$		3.5	6	

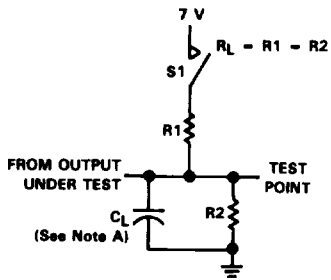
† All typical values are at  $V_{CC} = 5 V, T_A = 25^\circ C$ .

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

**switching characteristics (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5 V, C_L = 50 pF, R_1 = 500 \Omega, R_2 = 500 \Omega, T_A = 25^\circ C$			$V_{CC} = 4.5 V$ to 5.5 V, $C_L = 50 pF, R_1 = 500 \Omega, R_2 = 500 \Omega, T_A = \text{MIN to MAX}$		UNIT
			MIN	TYP	MAX	MIN	MAX	
$t_{PLH}$	A	Y		5	7	2	8	ns
$t_{PHL}$				5	7	2	8	
$t_{PZH}$	$\bar{G}$	Y		8	11	4	12	ns
$t_{PZL}$				10	14	6	16	
$t_{PHZ}$	$\bar{G}$	Y		10	14	4	16	ns
$t_{PLZ}$				8	12	3	14	

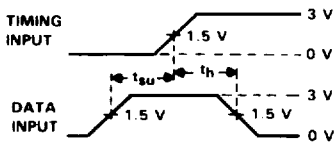
PARAMETER MEASUREMENT INFORMATION



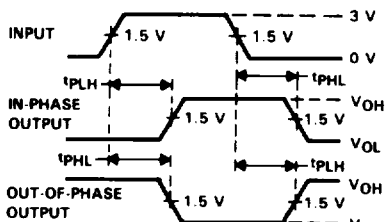
SWITCH POSITION TABLE

TEST	S1
t <sub>PLH</sub>	Open
t <sub>PHL</sub>	Open
t <sub>PZH</sub>	Open
t <sub>PZL</sub>	Closed
t <sub>PHZ</sub>	Open
t <sub>PLZ</sub>	Closed

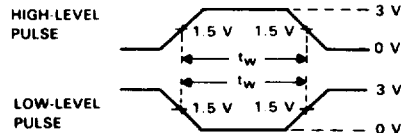
LOAD CIRCUIT



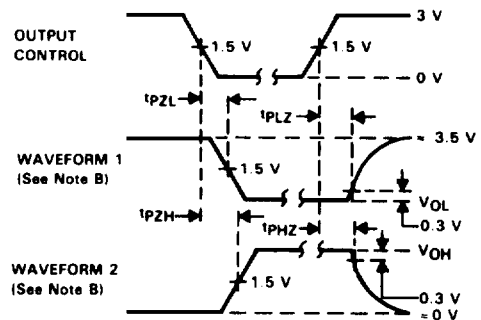
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS  
PULSE DURATIONS



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES, THREE-STATE OUTPUTS

- NOTES: A. C<sub>L</sub> includes probe and jig capacitance.  
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.  
Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.  
C. All input pulses are supplied by the generators having the following characteristics: PRR ≤ 10 MHz, Z<sub>0</sub> = 50 Ω, t<sub>r</sub> ≤ 2.5 ns, t<sub>f</sub> ≤ 2.5 ns.

FIGURE 1. SWITCHING CHARACTERISTICS