

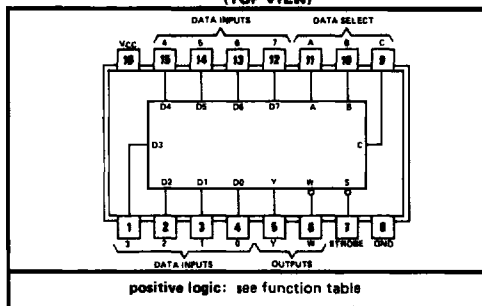
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**TYPES SN54251, SN54LS251, SN54S251,
SN74251, SN74LS251 (TIM9905), SN74S251**
DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

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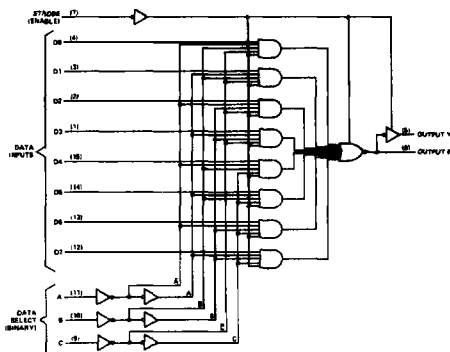
SN54251, SN54LS251, SN54S251 . . . J OR W PACKAGE
SN74251, SN74LS251, SN74S251 . . . J OR N PACKAGE

- Three-State Versions of '151, 'LS151, 'S151
- Three-State Outputs Interface Directly with System Bus
- Perform Parallel-to-Serial Conversion
- Permit Multiplexing from N-lines to One Line
- Complementary Outputs Provide True and Inverted Data
- Fully Compatible with Most TTL and DTL Circuits



TYPE	MAX NO. OF COMMON OUTPUTS	TYPICAL DELAY TIME (D TO Y)	AVG PROP DELAY TIME	TYPICAL POWER DISSIPATION
SN54251	49	17 ns		250 mW
SN74251	129	17 ns		250 mW
SN54LS251	49	17 ns		35 mW
SN74LS251	129	17 ns		35 mW
SN54S251	39	8 ns		275 mW
SN74S251	129	8 ns		275 mW

functional block diagram



description

These monolithic data selectors/multiplexers contain full on-chip binary decoding to select one-of-eight data sources and feature a strobe-controlled three-state output. The strobe must be at a low logic level to enable these devices. The three-state outputs permit a number of outputs to be connected to a common bus. When the strobe input is high, both outputs are in a high-impedance state in which both the upper and lower transistors of each totem-pole output are off, and the output neither drives nor loads the bus significantly. When the strobe is low, the outputs are activated and operate as standard TTL totem-pole outputs.

To minimize the possibility that two outputs will attempt to take a common bus to opposite logic levels, the output control circuitry is designed so that the average output disable time is shorter than the average output enable time. The SN54251 and SN74251 have output clamp diodes to attenuate reflections on the bus line.

FUNCTION TABLE

INPUTS			OUTPUTS	
SELECT	STROBE		Y	W
C B A	S			
X X X	H		Z	Z
L L L	L		D ₀	$\overline{D_0}$
L L H	L		D ₁	$\overline{D_1}$
L H L	L		D ₂	$\overline{D_2}$
L H H	L		D ₃	$\overline{D_3}$
H L L	L		D ₄	$\overline{D_4}$
H L H	L		D ₅	$\overline{D_5}$
H H L	L		D ₆	$\overline{D_6}$
H H H	L		D ₇	$\overline{D_7}$

H = high logic level, L = low logic level
X = irrelevant, Z = high impedance (off)
D₀, D₁ . . . D₇ = the level of the respective D input

TYPES SN54251, SN74251 DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	5.5 V
Off-state output voltage	5.5 V
Operating free-air temperature range: SN54251	-55°C to 125°C
SN74251	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54251			SN74251			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			-2			-5.2	mA
Low-level output current, I_{OL}			16			16	mA
Operating free-air temperature, T_A	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
V_{IH} High-level input voltage		2			V
V_{IL} Low-level input voltage				0.8	V
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$			-1.5	V
V_{OH} High-level output voltage	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OH} = \text{MAX}$	2.4	3.2		V
V_{OL} Low-level output voltage	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 16 \text{ mA}$		0.2	0.4	V
I_{OZ} Off-state (high-impedance-state) output current	$V_{CC} = \text{MAX}$, $V_{IH} = 2 \text{ V}$			40	μA
				-40	
V_O Output clamp voltage	$V_{CC} = \text{MAX}$, $V_{IH} = 4.5 \text{ V}$			-1.5	V
				$V_{CC} + 1.5$	
I_I Input current at maximum input voltage	$V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$			1	mA
I_{IH} High-level input current	$V_{CC} = \text{MAX}$, $V_I = 2.4 \text{ V}$			40	μA
I_{IL} Low-level input current	$V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$			-1.6	mA
I_{OS} Short-circuit output current §	$V_{CC} = \text{MAX}$	-18		-55	mA
I_{CC} Supply current	$V_{CC} = \text{MAX}$, All inputs at 4.5 V, All outputs open		38	62	mA

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.

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

§Not more than one output should be shorted at a time.

TYPES SN54251, SN74251

DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

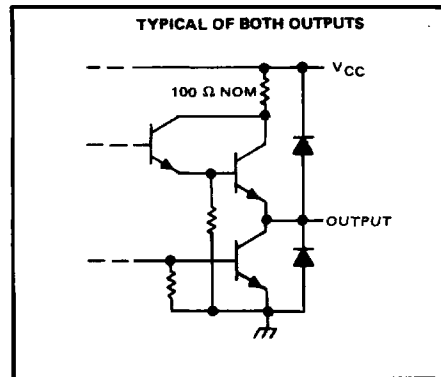
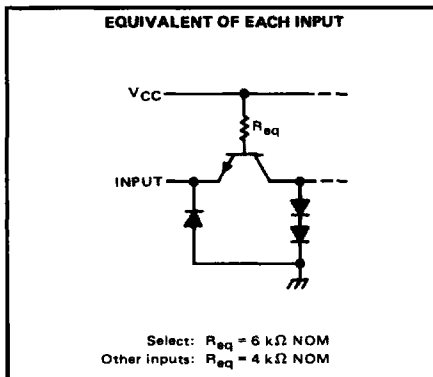
switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	A, B, or C (4 levels)	Y	$C_L = 50\text{ pF}$, $R_L = 400\ \Omega$, See Note 2	28	45	ns	
t_{PHL}				28	45		
t_{PLH}	A, B, or C (3 levels)	W		20	33	ns	
t_{PHL}				21	33		
t_{PLH}	Any D	Y		17	28	ns	
t_{PHL}				18	28		
t_{PLH}	Any D	W		10	15	ns	
t_{PHL}				9	15		
t_{ZH}	Strobe	Y		17	27	ns	
t_{ZL}				26	40		
t_{ZH}	Strobe	W	17	27	ns		
t_{ZL}			24	40			
t_{HZ}	Strobe	Y	5	8	ns		
t_{LZ}			15	23			
t_{HZ}	Strobe	W	5	8	ns		
t_{LZ}			15	23			

† t_{PLH} \equiv Propagation delay time, low-to-high-level output
 t_{PHL} \equiv Propagation delay time, high-to-low-level output
 t_{ZH} \equiv Output enable time to high level
 t_{ZL} \equiv Output enable time to low level
 t_{HZ} \equiv Output disable time from high level
 t_{LZ} \equiv Output disable time from low level

NOTE 2: See load circuits and waveforms on page 3-10.

schematics of inputs and outputs



TYPES SN54LS251, SN74LS251 (TIM0905) DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

REVISED OCTOBER 1976

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	7 V
Off-state output voltage	5.5 V
Operating free-air temperature range: SN54LS251	55°C to 125°C
SN74LS251	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54LS251			SN74LS251			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			-1			-2.6	mA
Low-level output current, I_{OL}			4			8	mA
Operating free-air temperature, T_A	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	SN54LS251		SN74LS251		UNIT	
		MIN	TYP‡	MAX	MIN		TYP‡
V_{IH} High-level input voltage		2		2		V	
V_{IL} Low-level input voltage				0.7		0.8	V
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}$, $I_I = -18 \text{ mA}$			-1.5		-1.5	V
V_{OH} High-level output voltage	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = \text{MAX}$, $I_{OH} = \text{MAX}$	2.4	3.4	2.4	3.1	V	
V_{OL} Low-level voltage	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = V_{IL \text{ max}}$						V
	$I_{OL} = 4 \text{ mA}$		0.25	0.4	0.25	0.4	
	$I_{OL} = 8 \text{ mA}$				0.35	0.5	
I_{OZ} Off-state (high-impedance-state) output current	$V_{CC} = \text{MAX}$, $V_{IH} = 2 \text{ V}$			20		20	μA
	$V_O = 2.7 \text{ V}$			-20		-20	
	$V_O = 0.4 \text{ V}$						
I_I Input current at maximum input voltage	$V_{CC} = \text{MAX}$, $V_I = 7 \text{ V}$			0.1		0.1	mA
I_{IH} High-level input current	$V_{CC} = \text{MAX}$, $V_I = 2.7 \text{ V}$			20		20	μA
I_{IL} Low-level input current	$V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$			-0.4		-0.4	mA
I_{OS} Short-circuit output current§	$V_{CC} = \text{MAX}$	-30		-130	-30	-130	mA
I_{CC} Supply current	$V_{CC} = \text{MAX}$, See Note 3						mA
	Condition A	6.1	10	6.1	10		
	Condition B	7.1	12	7.1	12		

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.

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

§Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

NOTE 3: I_{CC} is measured with the outputs open and all data and select inputs at 4.5 V under the following conditions:

- A. Strobe grounded.
- B. Strobe at 4.5 V.

TYPES SN54LS251, SN74LS251 (TIM9905)

DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	A, B, or C (4 levels)	Y	$C_L = 15\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Note 4	29	45	ns	
t_{PHL}				28	45		
t_{PLH}	A, B, or C (3 levels)	W		20	33	ns	
t_{PHL}				21	33		
t_{PLH}	Any D	Y		17	28	ns	
t_{PHL}				18	28		
t_{PLH}	Any D	W		10	15	ns	
t_{PHL}				9	15		
t_{ZH}	Strobe	Y		30	45	ns	
t_{ZL}				26	40		
t_{ZH}	Strobe	W	17	27	ns		
t_{ZL}			24	40			
t_{HZ}	Strobe	Y	$C_L = 5\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Note 4	30	45	ns	
t_{LZ}			15	25			
t_{HZ}	Strobe	W	37	55	ns		
t_{LZ}			15	25			

† t_{PLH} ≡ Propagation delay time, low-to-high-level output

t_{PHL} ≡ Propagation delay time, high-to-low-level output

t_{ZH} ≡ Output enable time to high level

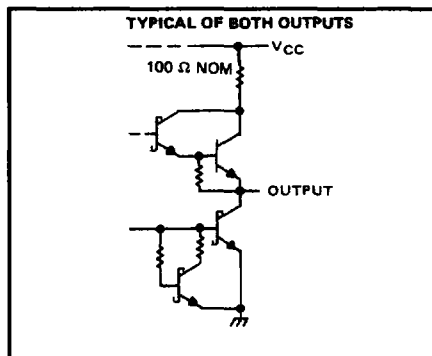
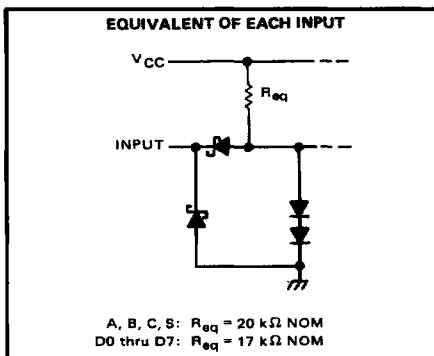
t_{ZL} ≡ Output enable time to low level

t_{HZ} ≡ Output disable time from high level

t_{LZ} ≡ Output disable time from low level

NOTE 4: See load circuits and waveforms on page 3-11.

schematics of inputs and outputs



TYPES SN54S251, SN74S251

DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	5.5 V
Off-state output voltage	5.5 V
Operating free-air temperature range: SN54S251	-55°C to 125°C
SN74S251	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54S251			SN74S251			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			-2			-8.5	mA
Low-level output current, I_{OL}			20			20	mA
Operating free-air temperature, T_A	-55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS†		MIN	TYP‡	MAX	UNIT
V_{IH}	High-level input voltage			2			V
V_{IL}	Low-level input voltage					0.8	V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$				-1.2	V
V_{OH}	High-level output voltage	$V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, I_{OH} = \text{MAX}$	SN54S'	2.4	3.4	V	
			SN74S'	2.4	3.2		
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, I_{OL} = 20 \text{ mA}$				0.5	V
I_{OZ}	Off-state (high-impedance-state) output current	$V_{CC} = \text{MAX}, V_{IH} = 2 \text{ V}$	$V_O = 2.4 \text{ V}$			50	μA
			$V_O = 0.5 \text{ V}$			-50	
I_I	Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$				1	mA
I_{IH}	High-level input current	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$				50	μA
I_{IL}	Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.5 \text{ V}$				-2	mA
I_{OS}	Short-circuit output current§	$V_{CC} = \text{MAX}$		-40		-100	mA
I_{CC}	Supply current	$V_{CC} = \text{MAX},$ All inputs at 4.5 V, All outputs open			55	85	mA

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.

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

§Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

TYPES SN54S251, SN74S251

DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	A, B, or C (4 levels)	Y	$C_L = 15\text{ pF}$, $R_L = 280\ \Omega$, See Note 2	12	18	ns	
t_{PHL}				13	19.5		
t_{PLH}	A, B, or C (3 levels)	W		10	15	ns	
t_{PHL}				9	13.5		
t_{PLH}	Any D	Y		8	12	ns	
t_{PHL}				8	12		
t_{PLH}	Any D	W		4.5	7	ns	
t_{PHL}				4.5	7		
t_{ZH}	Strobe	Y		$C_L = 50\text{ pF}$, $R_L = 280\ \Omega$, See Note 2	13	19.5	ns
t_{ZL}					14	21	
t_{ZH}	Strobe	W	13		19.5	ns	
t_{ZL}			14		21		
t_{HZ}	Strobe	Y	5.5		8.5	ns	
t_{LZ}			9		14		
t_{HZ}	Strobe	W	5.5	8.5	ns		
t_{LZ}			9	14			

† t_{PLH} = Propagation delay time, low-to-high-level output
 t_{PHL} = Propagation delay time, high-to-low-level output
 t_{ZH} = Output enable time to high level
 t_{ZL} = Output enable time to low level
 t_{HZ} = Output disable time from high level
 t_{LZ} = Output disable time from low level

NOTE 2: See load circuits and waveforms on page 3-10.

schematics of inputs and outputs

