SN54150, SN54151A, SN54LS151, SN54S151, SN74150, SN74151A, SN74LS151, SN74S151 DATA SELECTORS/MULTIPLEXERS

DECEMBER 1972—REVISED MARCH 1988

- '150 Selects One-of-Sixteen Data Sources
- Others Select One-of-Eight Data Sources
- All Perform Parallel-to-Serial Conversion
- All Permit Multiplexing from N Lines to One Line
- Also For Use as Boolean Function Generator
- Input-Clamping Diodes Simplify System Design
- Fully Compatible with Most TTL Circuits

TYPE	TYPICAL AVERAGE PROPAGATION DELAY TIME DATA INPUT TO W OUTPUT	TYPICAL POWER DISSIPATION
'150	13 ns	200 mW
'151A	8 ns	145 mW
'LS151	13 ns	30 mW
'S151	4.5 ns	225 mW

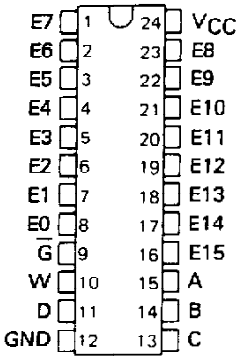
description

These monolithic data selectors/multiplexers contain full on-chip binary decoding to select the desired data source. The '150 selects one-of-sixteen data sources; the '151A, 'LS151, and 'S151 select one-of-eight data sources. The '150, '151A, 'LS151, and 'S151 have a strobe input which must be at a low logic level to enable these devices. A high level at the strobe forces the W output high, and the Y output (as applicable) low.

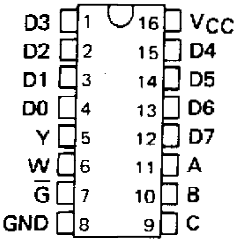
The '150 has only an inverted W output; the '151A, 'LS151, and 'S151 feature complementary W and Y outputs.

The '151A and '152A incorporate address buffers that have symmetrical propagation delay times through the complementary paths. This reduces the possibility of transients occurring at the output(s) due to changes made at the select inputs, even when the '151A outputs are enabled (i.e., strobe low).

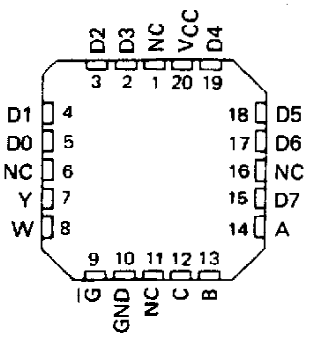
SN54150 . . . J OR W PACKAGE
SN74150 . . . N PACKAGE
(TOP VIEW)



SN54151A, SN54LS151, SN54S151 . . . J OR W PACKAGE
SN74151A . . . N PACKAGE
SN74LS151, SN74S151 . . . D OR N PACKAGE
(TOP VIEW)



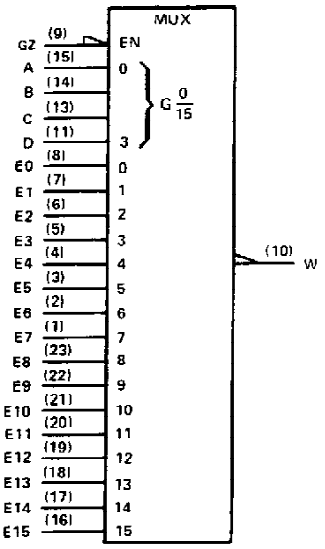
SN54LS151, SN54S151 . . . FK PACKAGE
(TOP VIEW)



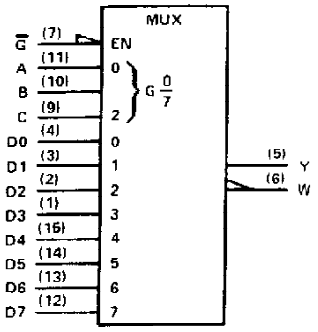
NC - No internal connection

logic symbols†

'150



'151A, 'LS151, 'S151



†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.
Pin numbers shown are D, J, N, and W packages.

'150

FUNCTION TABLE

INPUTS					OUTPUT
SELECT				STROBE	
D	C	B	A	$\overline{G}$	W
X	X	X	X	H	H
L	L	L	L	L	$\overline{E0}$
L	L	L	H	L	$\overline{E1}$
L	L	H	L	L	$\overline{E2}$
L	L	H	H	L	$\overline{E3}$
L	H	L	L	L	$\overline{E4}$
L	H	L	H	L	$\overline{E5}$
L	H	H	L	L	$\overline{E6}$
L	H	H	H	L	$\overline{E7}$
H	L	L	L	L	$\overline{E8}$
H	L	L	H	L	$\overline{E9}$
H	L	H	L	L	$\overline{E10}$
H	L	H	H	L	$\overline{E11}$
H	H	L	L	L	$\overline{E12}$
H	H	L	H	L	$\overline{E13}$
H	H	H	L	L	$\overline{E14}$
H	H	H	H	L	$\overline{E15}$

'151A, 'LS151, 'S151

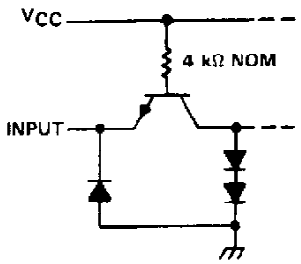
FUNCTION TABLE

INPUTS				OUTPUTS	
SELECT			STROBE		
C	B	A	$\overline{G}$	Y	W
X	X	X	H	L	H
L	L	L	L	D0	$\overline{D0}$
L	L	H	L	D1	$\overline{D1}$
L	H	L	L	D2	$\overline{D2}$
L	H	H	L	D3	$\overline{D3}$
H	L	L	L	D4	$\overline{D4}$
H	L	H	L	D5	$\overline{D5}$
H	H	L	L	D6	$\overline{D6}$
H	H	H	L	D7	$\overline{D7}$

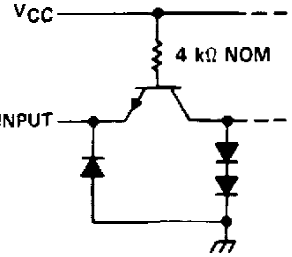
H = high level, L = low level, X = irrelevant
$\overline{E0}$, $\overline{E1}$ . . . $\overline{E15}$ = the complement of the level of the respective E input
D0, D1 . . . D7 = the level of the D respective input

schematics of inputs and outputs

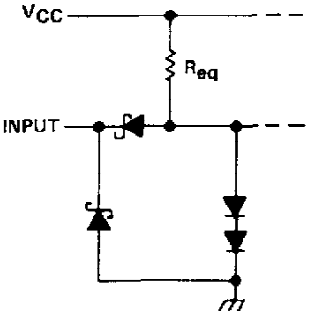
EQUIVALENT OF EACH INPUT OF '150



EQUIVALENT OF EACH INPUT OF '151A

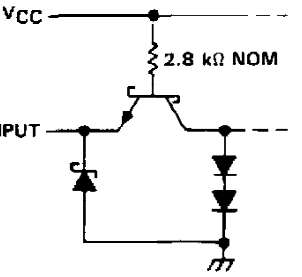


EQUIVALENT OF EACH INPUT OF 'LS151

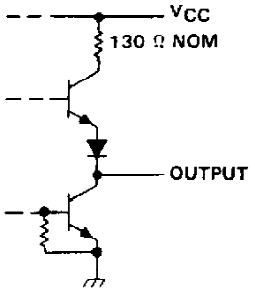


Data select and strobe R_{eq} = 20 kΩ NOM
Data inputs R_{eq} = 17 kΩ NOM

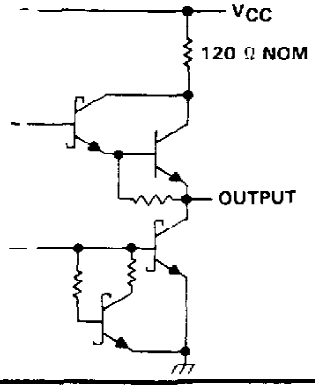
EQUIVALENT OF EACH INPUT OF 'S151



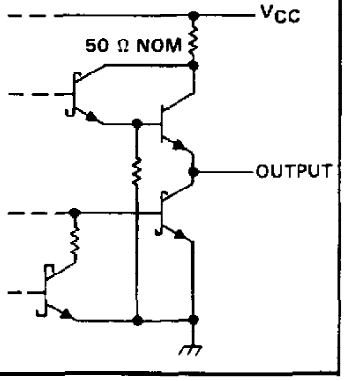
TYPICAL OF ALL OUTPUTS OF '150, '151A



TYPICAL OF ALL OUTPUTS OF 'LS151



TYPICAL OF ALL OUTPUTS OF 'S151



recommended operating conditions

	SN54'			SN74'			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}			−800			−800	μA
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†		'150			'151A			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage			2			2			V
V_{IL}	Low-level input voltage					0.8			0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −8 mA				−1.5			−1.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = −800 μA		2.4	3.4		2.4	3.4		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = 16 mA			0.2	0.4		0.2	0.4	V
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				1			1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.4 V				40			40	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.4 V				−1.6			−1.6	mA
I_{OS}	Short-circuit output current§	V_{CC} = MAX	SN54'	−20		−55	−20		−55	mA
			SN74'	−18		−55	−18		−55	
I_{CC}	Supply current	V_{CC} = MAX, See Note 3			40	68		29	48	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.
‡ All typical values at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output of the '151A should be shorted at a time.
NOTE 3: I_{CC} is measured with the strobe and data select inputs at 4.5 V, all other inputs and outputs open.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER¶	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'150			'151A			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	A, B, or C (4 levels)	Y	C_L = 15 pF, R_L = 400 Ω, See Note 4					25	38	ns
t_{PHL}								25	38	
t_{PLH}	A, B, C, or D (3 levels)	W			23	35		17	26	ns
t_{PHL}					22	33		19	30	
t_{PLH}	Strobe $\overline{G}$	Y						21	33	ns
t_{PHL}								22	33	
t_{PLH}	Strobe $\overline{G}$	W			15.5	24		14	21	ns
t_{PHL}					21	30		15	23	
t_{PLH}	D0 thru D7	Y						13	20	ns
t_{PHL}								18	27	
t_{PLH}	E0 thru E15, or D0 thru D7	W			8.5	14		8	14	ns
t_{PHL}					13	20		8	14	

¶ t_{PLH} = propagation delay time, low-to-high-level output
t_{PHL} = propagation delay time, high-to-low-level output
NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

recommended operating conditions

	SN54LS151			SN74LS151			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}			−400			−400	μA
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†		SN54LS151			SN74LS151			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
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} = MIN, I_I = −18 mA				−1.5			−1.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL}max, I_{OH} = −400 μA		2.5	3.4		2.7	3.4		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL}max	I_{OL} = 4 mA		0.25	0.4		0.25	0.4	V
			I_{OL} = 8 mA					0.35	0.5	
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 7 V				0.1			0.1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				20			20	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.4 V				−0.4			−0.4	mA
I_{OS}	Short-circuit output current§	V_{CC} = MAX		−20		−100	−20		−100	mA
I_{CC}	Supply current	V_{CC} = MAX, Outputs open, All inputs at 4.5 V			6.0	10		6.0	10	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time and duration of short-circuit should not exceed one second.

switching characteristics, V_{CC} = 5 V, T_A 25°C

PARAMETER¶	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	A, B, or C (4 levels)	Y	C_L = 15 pF, R_L = 2 kΩ, See Note 4		27	43	ns
t_{PHL}					18	30	
t_{PLH}	A, B, or C (3 levels)	W			14	23	ns
t_{PHL}					20	32	
t_{PLH}	Strobe $\overline{G}$	Y			26	42	ns
t_{PHL}					20	32	
t_{PLH}	Strobe $\overline{G}$	W			15	24	ns
t_{PHL}					18	30	
t_{PLH}	Any D	Y			20	32	ns
t_{PHL}					16	26	
t_{PLH}	Any D	W			13	21	ns
t_{PHL}					12	20	

¶ t_{PLH} = propagation delay time, low-to-high-level output
t_{PHL} = propagation delay time, high-to-low-level output
NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

recommended operating conditions

	SN54S151			SN74S151			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			−1	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} = MIN, I_I = −18 mA				−1.2	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = −1 mA	SN54S151	2.5	3.4		V
			SN74S151	2.7	3.4		
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = 20 mA				0.5	V
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7 V				50	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.5 V				−2	mA
I_{OS}	Short-circuit output current§	V_{CC} = MAX		−40		−100	mA
I_{CC}	Supply current	V_{CC} = MAX, All inputs at 4.5 V, All outputs open			45	70	mA

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.
‡All typical values are at V_{CC} = 5 V, T_A = 25°C.
§Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

switching characteristics, V_{CC} = 5 V, T_A 25°C

PARAMETER¶	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	A, B, or C (4 levels)	Y	C_L = 15 pF, R_L = 280 kΩ, See Note 4		12	18	ns
t_{PHL}					12	18	
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_{PLH}	Strobe $\overline{G}$	Y			11	16.5	ns
t_{PHL}					12	18	
t_{PLH}	Strobe $\overline{G}$	W			9	13	ns
t_{PHL}					8.5	12	

¶t_{PLH} = propagation delay time, low-to-high-level output
t_{PHL} = propagation delay time, high-to-low-level output
NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

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