HEX BUS DRIVERS WITH 3-STATE OUTPUTS

DECEMBER 1983—REVISED MARCH 1988

- **3-State Outputs Drive Bus Lines or Buffer Memory Address Registers**
- **Choice of True or Inverting Outputs**
- **Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs**
- **Dependable Texas Instruments Quality and Reliability**

'365A, '367A, 'LS365A, 'LS367A True Outputs '366A, '368A, 'LS366A, 'LS368A Inverting Outputs

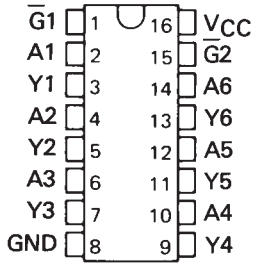
description

These Hex buffers and line drivers are designed specifically to improve both the performance and density of three-state memory address drivers, clock drivers, and bus oriented receivers and transmitters. The designer has choice of selected combinations of inverting and noninverting outputs, symmetrical $\overline{G}$ (active-low control) inputs.

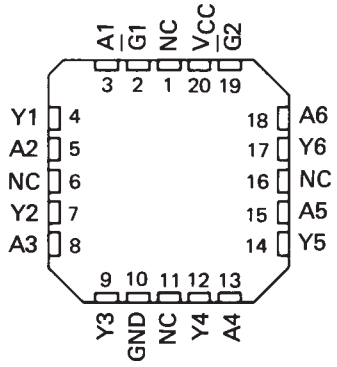
These devices feature high fan-out, improved fan-in, and can be used to drive terminated lines down to 133 ohms.

The SN54365A thru SN54368A and SN54LS365A thru SN54LS368A are characterized for operation over the full military temperature range of −55°C to 125°C. The SN74365A thru SN74368A and SN74LS365A thru SN74LS368A are characterized for operation from 0°C to 70°C.

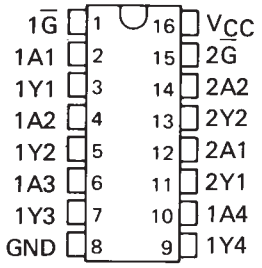
SN54365A, 366A, SN54LS365A, 366A . . . J PACKAGE
SN74365A, 366A . . . N PACKAGE
SN74LS365A, SN74LS366A . . . D OR N PACKAGE
(TOP VIEW)



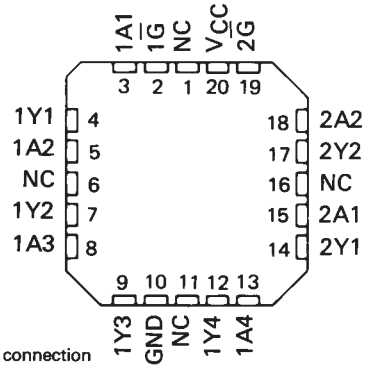
SN54LS365A, SN54LS366A . . . FK PACKAGE
(TOP VIEW)



SN54367A, 368A, SN54LS367A, 368A . . . J PACKAGE
SN74367A, 368A . . . N PACKAGE
SN74LS367A, SN74LS368A . . . D OR N PACKAGE
(TOP VIEW)



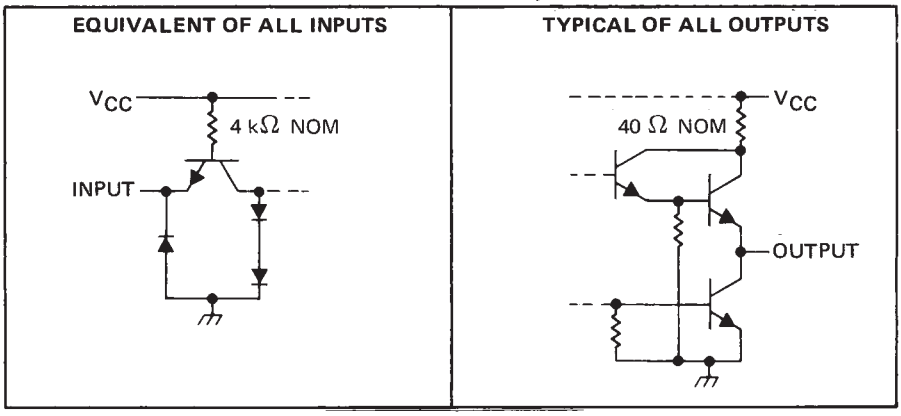
SN54LS367A, SN54LS368A . . . FK PACKAGE
(TOP VIEW)



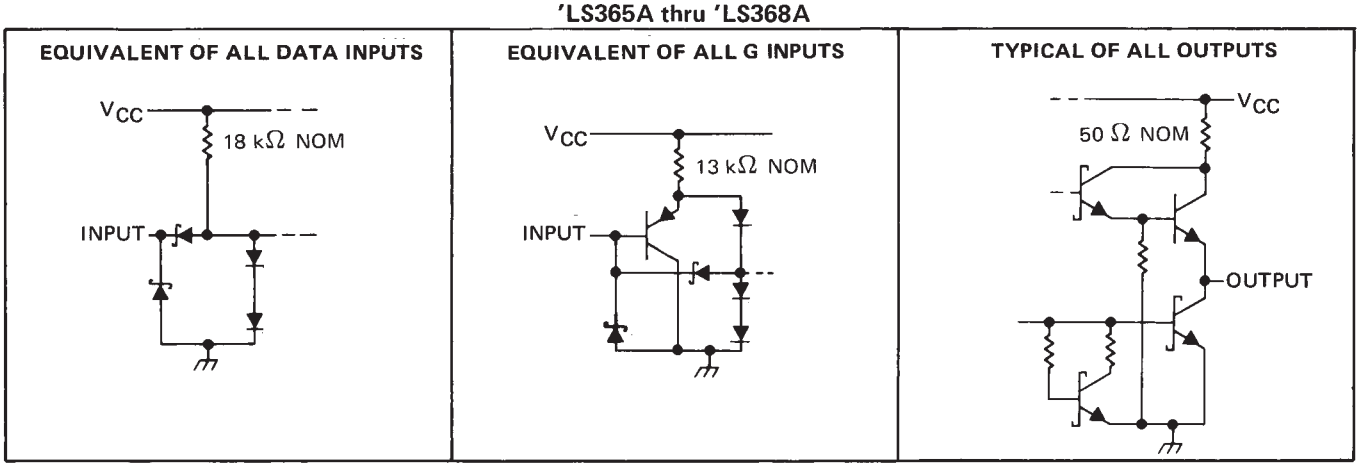
NC – No internal connection

schematics of inputs and outputs

'365A thru '368A

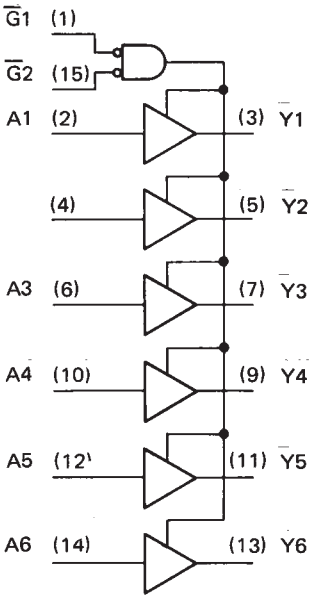


'LS365A thru 'LS368A

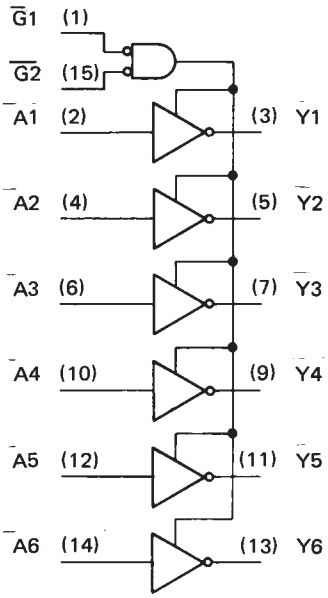


logic diagrams (positive logic)

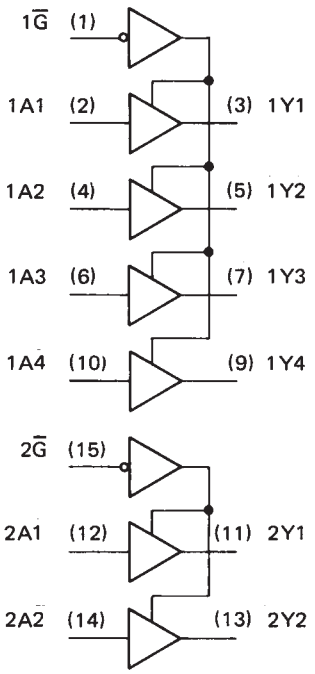
'365A, 'LS365A



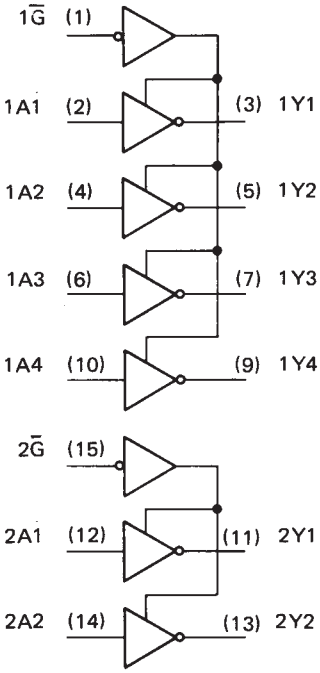
'366A, 'LS366A



'367A, 'LS367A



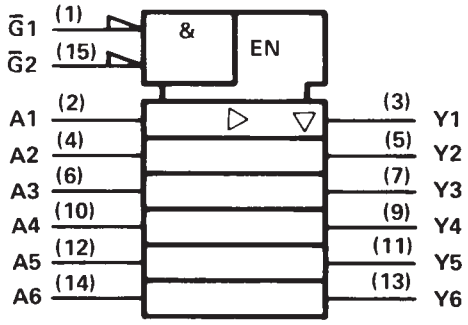
'368A, 'LS368A



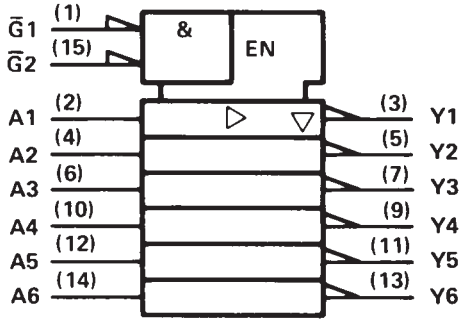
Pin numbers shown are for D, J, and N packages.

logic symbols†

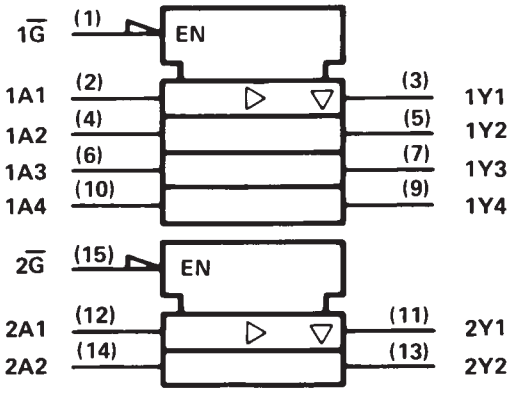
'365A



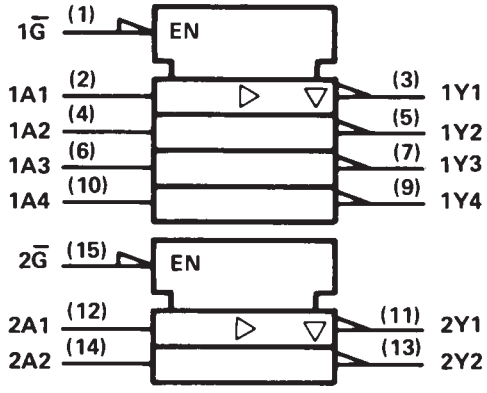
'366A



'367A



'368A



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

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

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage: '365A, '366A, '367A, '368A . . . . . 5.5 V
'LS365A, 'LS366A, 'LS367A, 'LS368A . . . . . 7 V
Voltage applied to a disabled 3-state output . . . . . 5.5 V
Operating free-air temperature: SN54' . . . . . −55°C to 125°C
SN74' . . . . . 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

		SN54365A SN54367A			SN74365A SN74367A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.8			0.8	V
I_{OH}	High-level output current			−2			−5.2	mA
I_{OL}	Low-level output current			32			32	mA
T_A	Operating free-air temperature	−55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS†			SN54365A SN54367A			SN74365A SN74367A			UNIT
					MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}		V_{CC} = MIN,	I_I = −12 mA				−1.5			−1.5	V
V_{OH}		V_{CC} = MIN, I_{OH} = MAX	V_{IH} = 2 V,	V_{IL} = 0.8 V,	2.4	3.3		2.4	3.1		V
V_{OL}		V_{CC} = MIN, I_{OL} = 32 mA	V_{IH} = 2 V,	V_{IL} = 0.8 V,			0.4			0.4	V
I_{OZ}		V_{CC} = MAX, V_O = 2.4 V	V_{IH} = 2 V,	V_{IL} = 0.8 V,			40			40	μA
		V_{CC} = MAX, V_O = 0.4 V	V_{IH} = 2 V	V_{IL} = 0.8 V,			−40			−40	
I_I		V_{CC} = MAX,	V_I = 5.5 V				1			1	mA
I_{IH}		V_{CC} = MAX,	V_I = 2.4 V				40			40	μA
I_{IL}	A Inputs	V_{CC} = MAX,	V_I = 0.5 V,	Either $\overline{G}$ input at 2 V			−40			−40	μA
	A Inputs	V_{CC} = MAX,	V_I = 0.4 V,	Both $\overline{G}$ inputs at 0.4 V			−1.6			−1.6	mA
	$\overline{G}$ Inputs	V_{CC} = MAX,	V_I = 0.4 V				−1.6			−1.6	
I_{OS}§		V_{CC} = MAX			−40		−130	−40		−130	mA
I_{CC}		V_{CC} = MAX,	Data inputs = 0 V,	Output controls = 4.5 V		65	85		65	85	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{PLH}	Any	Y	R_L = 400 Ω,	C_L = 50 pF			16	ns
t_{PHL}							22	ns
t_{PZH}							35	ns
t_{PZL}							37	ns
t_{PHZ}			R_L = 400 Ω,	C_L = 5 pF			11	ns
t_{PLZ}							27	ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

recommended operating conditions

		SN54366A SN54368A			SN74366A SN74368A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.8			0.8	V
I_{OH}	High-level output current			−2			−5.2	mA
I_{OL}	Low-level output current			32			32	mA
T_A	Operating free-air temperature	−55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS†			SN54366A SN54368A			SN74366A SN74368A			UNIT
					MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}		V_{CC} = MIN, I_I = −12 mA					−1.5			−1.5	V
V_{OH}		V_{CC} = MIN, I_{OH} = MAX	V_{IH} = 2 V,	V_{IL} = 0.8 V,	2.4	3.3		2.4	3.1		V
V_{OL}		V_{CC} = MIN, I_{OL} = 32 mA	V_{IH} = 2 V,	V_{IL} = 0.8 V,			0.4			0.4	V
I_{OZ}		V_{CC} = MAX, V_O = 2.4 V	V_{IH} = 2 V,	V_{IL} = 0.8 V,			40			40	μA
		V_{CC} = MAX, V_O = 0.4 V	V_{IH} = 2 V	V_{IL} = 0.8 V,			−40			−40	
I_I		V_{CC} = MAX,	V_I = 5.5 V				1			1	mA
I_{IH}		V_{CC} = MAX,	V_I = 2.4 V				40			40	μA
I_{IL}	A Inputs	V_{CC} = MAX,	V_I = 0.5 V,	Either $\overline{G}$ input at 2 V			−40			−40	μA
		V_{CC} = MAX,	V_I = 0.4 V,	Both $\overline{G}$ inputs at 0.4 V			−1.6			−1.6	mA
	$\overline{G}$ Inputs	V_{CC} = MAX,	V_I = 0.4 V				−1.6			−1.6	
I_{OS}§		V_{CC} = MAX			−40		−130	−40		−130	mA
I_{CC}		V_{CC} = MAX,	Data inputs = 0 V,	Output controls = 4.5 V,		59	77		59	77	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{PLH}	Any	Y	R_L = 400 Ω,	C_L = 50 pF			17	ns
t_{PHL}							16	ns
t_{PZH}							35	ns
t_{PZL}							37	ns
t_{PHZ}			R_L = 400 Ω,	C_L = 5 pF			11	ns
t_{PLZ}							27	ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

recommended operating conditions

		SN54LS365A SN54LS367A			SN74LS365A SN74LS367A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.7			0.8	V
I_{OH}	High-level output current			−1			−2.6	mA
I_{OL}	Low-level output current			12			24	mA
T_A	Operating free-air temperature	−55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS†			SN54LS365A SN54LS367A			SN74LS365A SN74LS367A			UNIT
					MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}		V_{CC} = MIN,	I_I = −18 mA				−1.5			−1.5	V
V_{OH}		V_{CC} = MIN, I_{OH} = MAX	V_{IH} = 2 V,	V_{IL} = MAX,	2.4	3.3		2.4	3.1		V
V_{OL}		V_{CC} = MIN, I_{OL} = 12 mA	V_{IH} = 2 V,	V_{IL} = MAX,		0.25	0.4		0.25	0.4	V
		V_{CC} = MIN, I_{OL} = 24 mA	V_{IH} = 2 V,	V_{IL} = 0.8 V,					0.35	0.5	
I_{OZ}		V_{CC} = MAX, V_O = 2.4 V	V_{IH} = 2 V,	V_{IL} = MAX,			20			20	μA
		V_{CC} = MAX, V_O = 0.4 V	V_{IH} = 2 V,	V_{IL} = MAX,			−20			−20	
I_I		V_{CC} = MAX,	V_I = 7 V				0.1			0.1	mA
I_{IH}		V_{CC} = MAX,	V_I = 2.7 V				20			20	μA
I_{IL}	A Inputs	V_{CC} = MAX,	V_I = 0.5 V,	Either $\overline{G}$ input at 2 V			−20			−20	μA
	A Inputs	V_{CC} = MAX,	V_I = 0.4 V,	Both $\overline{G}$ inputs at 0.4 V			−0.4			−0.4	mA
	$\overline{G}$ Inputs	V_{CC} = MAX,	V_I = 0.4 V				−0.2			−0.2	
I_{OS}§		V_{CC} = MAX			−40		−225	−40		−225	mA
I_{CC}		V_{CC} = MAX,	Data inputs = 0 V,	Output controls = 4.5 V,		14	24		14	24	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ 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 the duration of the short circuit should not exceed one second.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Any	Y	R_L = 667 Ω, C_L = 45 pF		10	16	ns
t_{PHL}					9	22	ns
t_{PZH}					19	35	ns
t_{PZL}					24	40	ns
t_{PHZ}			R_L = 667 Ω, C_L = 5 pF			30	ns
t_{PLZ}						35	ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

recommended operating conditions

		SN54LS366A SN54LS368A			SN74LS366A SN74LS368A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.7			0.8	V
I_{OH}	High-level output current			−1			−2.6	mA
I_{OL}	Low-level output current			12			24	mA
T_A	Operating free-air temperature	−55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS†			SN54LS366A SN54LS368A			SN74LS366A SN74LS368A			UNIT
					MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}		V_{CC} = MIN,	I_I = −18 mA				−1.5			−1.5	V
V_{OH}		V_{CC} = MIN, I_{OH} = MAX	V_{IH} = 2 V,	V_{IL} = MAX,	2.4	3.3		2.4	3.1		V
V_{OL}		V_{CC} = MIN, I_{OL} = 12 mA	V_{IH} = 2 V,	V_{IL} = MAX,		0.25	0.4		0.25	0.4	V
		V_{CC} = MIN, I_{OL} = 24 mA	V_{IH} = 2 V,	V_{IL} = 0.8 V,					0.35	0.5	
I_{OZ}		V_{CC} = MAX, V_O = 2.4 V	V_{IH} = 2 V,	V_{IL} = MAX,			20			20	μA
		V_{CC} = MAX, V_O = 0.4 V	V_{IH} = 2 V,	V_{IL} = MAX,			−20			−20	
I_I		V_{CC} = MAX,	V_I = 7 V				0.1			0.1	mA
I_{IH}		V_{CC} = MAX,	V_I = 2.7 V				20			20	μA
I_{IL}	A Inputs	V_{CC} = MAX,	V_I = 0.5 V,	Either $\overline{G}$ input at 2 V			−20			−20	uA
		V_{CC} = MAX,	V_I = 0.4 V,	Both $\overline{G}$ inputs at 0.4 V			−0.4			−0.4	mA
	$\overline{G}$ Inputs	V_{CC} = MAX,	V_I = 0.4 V				−0.2			−0.2	
I_{OS}§		V_{CC} = MAX			−40		−225	−40		−225	mA
I_{CC}		V_{CC} = MAX,	Data inputs = 0 V,	Output controls = 4.5 V,		12	21		12	21	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ 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 the duration of the short circuit should not exceed one second.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Any	Y	R_L = 667 Ω, C_L = 45 pF		7	15	ns
t_{PHL}					12	18	ns
t_{PZH}					18	35	ns
t_{PZL}					28	45	ns
t_{PHZ}			R_L = 667 Ω, C_L = 5 pF			32	ns
t_{PLZ}						35	ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

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