

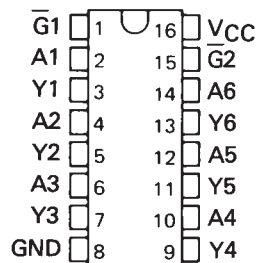
# SN54365A THRU SN54368A, SN54LS365A THRU SN54LS368A SN74365A THRU SN74368A, SN74LS365A THRU SN74LS368A HEX BUS DRIVERS WITH 3-STATE OUTPUTS

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

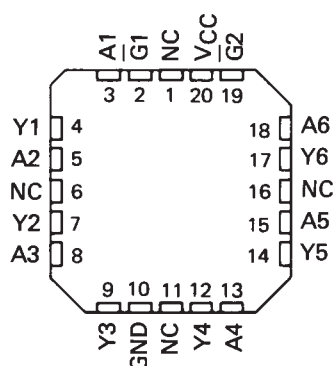
SN54365A, 366A, SN54LS365A, 366A . . . J PACKAGE  
SN74365A, 366A . . . N PACKAGE  
SN74LS365A, SN74LS366A . . . D OR N PACKAGE

(TOP VIEW)



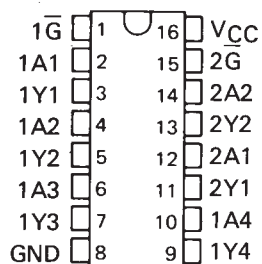
SN54LS365A, SN54LS366A . . . FK PACKAGE

(TOP VIEW)



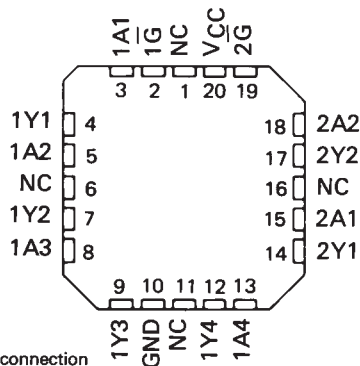
SN54367A, 368A, SN54LS367A, 368A . . . J PACKAGE  
SN74367A, 368A . . . N PACKAGE  
SN74LS367A, SN74LS368A . . . D OR N PACKAGE

(TOP VIEW)



SN54LS367A, SN54LS368A . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

## 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  $\bar{G}$  (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  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74365A thru SN74368A and SN74LS365A thru SN74LS368A are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

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PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

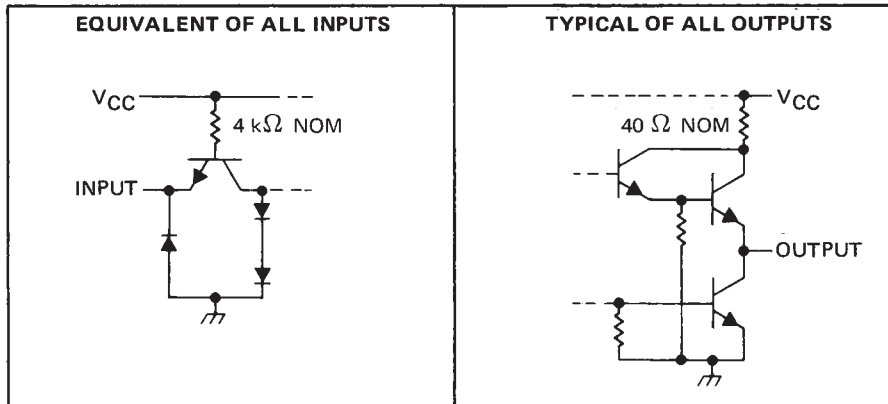
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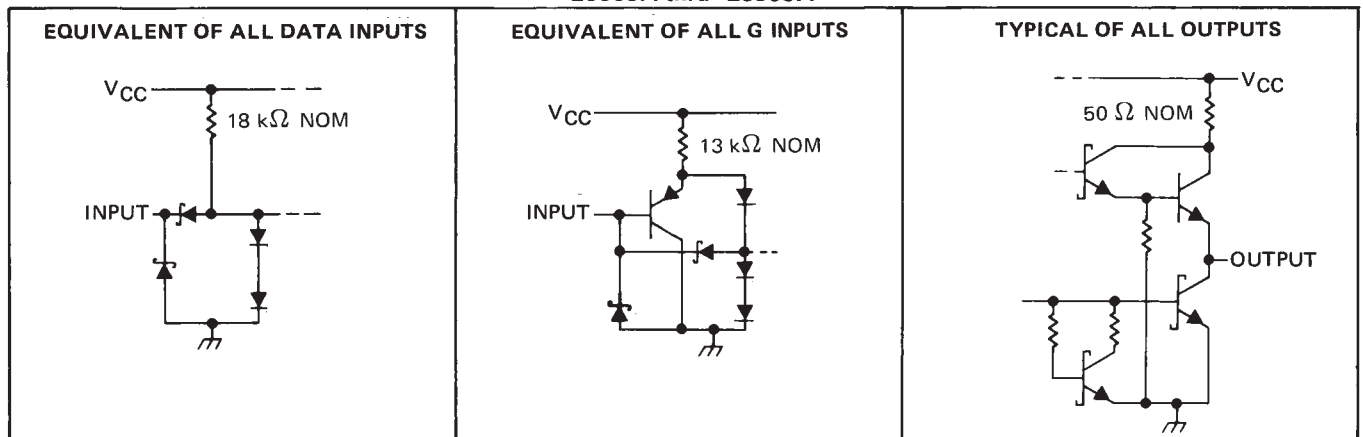
# SN54365A THRU SN54368A, SN54LS365A THRU SN54LS368A SN74365A THRU SN74368A, SN74LS365A THRU SN74LS368A HEX BUS DRIVERS WITH 3-STATE OUTPUTS

schematics of inputs and outputs

'365A thru '368A



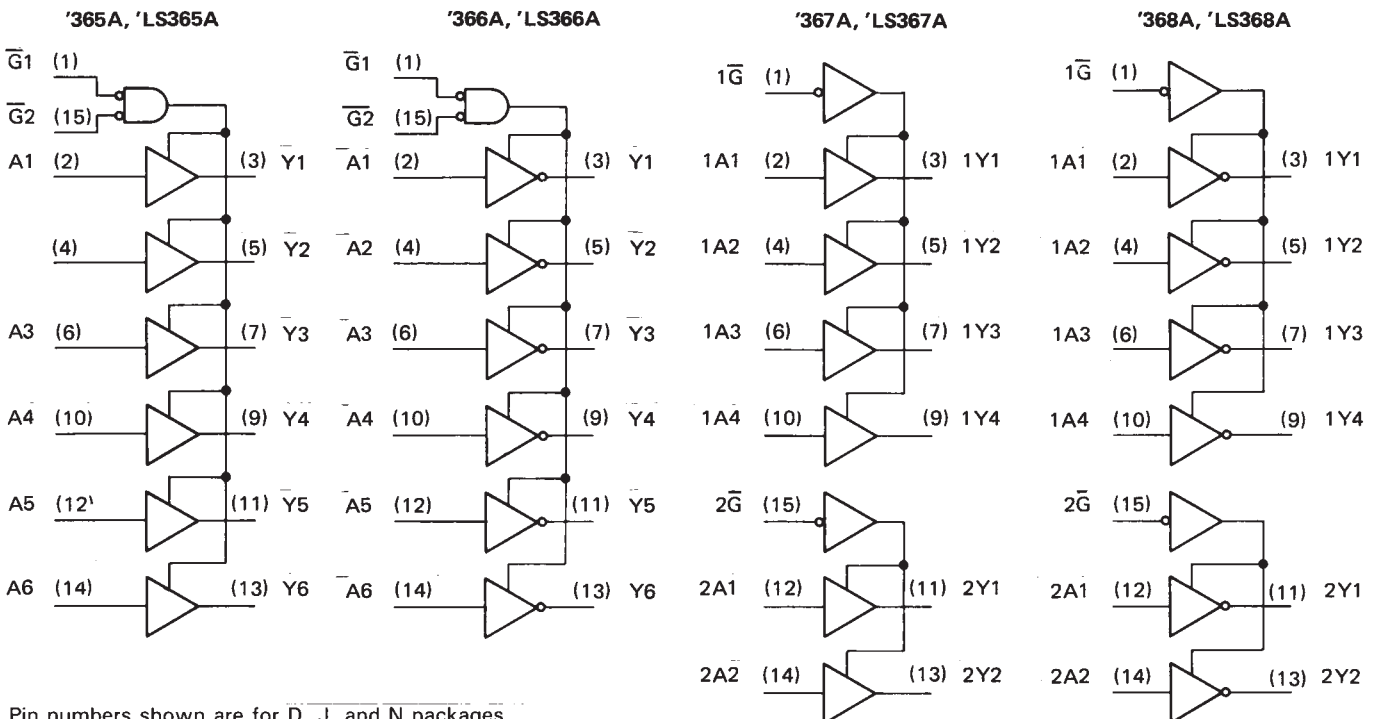
'LS365A thru 'LS368A



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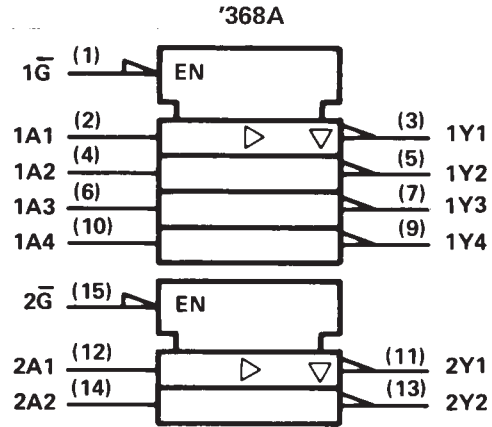
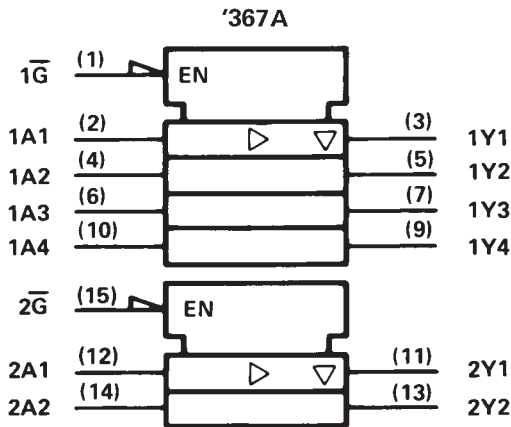
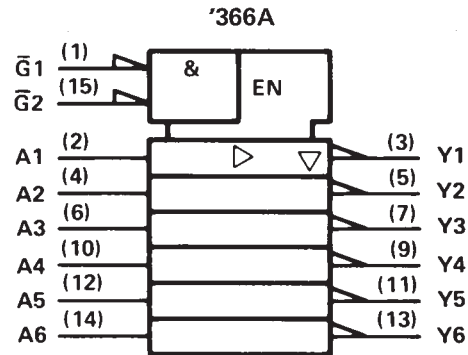
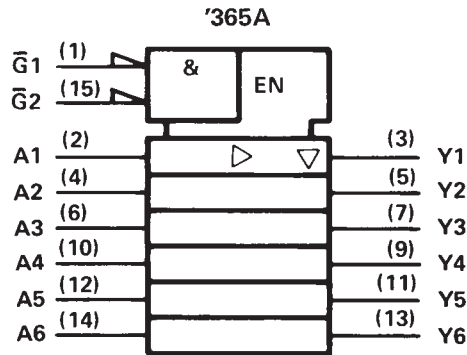
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logic diagrams (positive logic)



# SN54365A THRU SN54368A, SN54LS365A THRU SN54LS368A SN74365A THRU SN74368A, SN74LS365A THRU SN74LS368A HEX BUS DRIVERS WITH 3-STATE OUTPUTS

logic symbols†



†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.

**SN54365A, SN54367A  
SN74365A, SN74367A  
HEX BUS DRIVERS WITH 3-STATE OUTPUTS**

**recommended operating conditions**

	SN54365A SN54367A			SN74365A SN74367A			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage			0.8			0.8	V
I <sub>OH</sub> High-level output current			-2			-5.2	mA
I <sub>OL</sub> Low-level output current			32			32	mA
T <sub>A</sub> 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 <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -12 mA			-1.5			-1.5	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = MAX	2.4	3.3		2.4	3.1		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 32 mA			0.4			0.4	V
I <sub>OZ</sub>	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, V <sub>O</sub> = 2.4 V			40			40	μA
	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, V <sub>O</sub> = 0.4 V			-40			-40	
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			1			1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V			40			40	μA
I <sub>IL</sub>	A Inputs V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V, Either $\bar{G}$ input at 2 V			-40			-40	μA
	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V, Both $\bar{G}$ inputs at 0.4 V			-1.6			-1.6	
	$\bar{G}$ Inputs V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			-1.6			-1.6	mA
I <sub>OS</sub> §	V <sub>CC</sub> = MAX	-40		-130	-40		-130	mA
I <sub>CC</sub>	V <sub>CC</sub> = 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<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

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

**switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
t <sub>PLH</sub>	Any	Y	R <sub>L</sub> = 400 Ω, C <sub>L</sub> = 50 pF			16	ns	
t <sub>PHL</sub>						22	ns	
t <sub>PZH</sub>						35	ns	
t <sub>PZL</sub>						37	ns	
t <sub>PHZ</sub>							11	ns
t <sub>PLZ</sub>						R <sub>L</sub> = 400 Ω, C <sub>L</sub> = 5 pF		

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

**SN54366A, SN54368A**  
**SN74366A, SN74368A**  
**HEX BUS DRIVERS WITH 3-STATE OUTPUTS**

**recommended operating conditions**

	SN54366A SN54368A			SN74366A SN74368A			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage			0.8			0.8	V
I <sub>OH</sub> High-level output current			-2			-5.2	mA
I <sub>OL</sub> Low-level output current			32			32	mA
T <sub>A</sub> 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 <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -12 mA			-1.5			-1.5	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = MAX	2.4	3.3		2.4	3.1		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 32 mA			0.4			0.4	V
I <sub>OZ</sub>	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, V <sub>O</sub> = 2.4 V			40			40	μA
	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, V <sub>O</sub> = 0.4 V			-40			-40	
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			1			1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V			40			40	μA
I <sub>IL</sub>	A Inputs V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V, Either $\bar{G}$ input at 2 V			-40			-40	μA
	$\bar{G}$ Inputs V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V, Both $\bar{G}$ inputs at 0.4 V			-1.6			-1.6	
I <sub>OS</sub> §	V <sub>CC</sub> = MAX			-40			-130	mA
I <sub>CC</sub>	V <sub>CC</sub> = MAX, Data inputs = 0 V, Output controls = 4.5 V,			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<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

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

**switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
t <sub>PLH</sub>	Any	Y	R <sub>L</sub> = 400 Ω, C <sub>L</sub> = 50 pF			17	ns	
t <sub>PHL</sub>						16	ns	
t <sub>PZH</sub>						35	ns	
t <sub>PZL</sub>						37	ns	
t <sub>PHZ</sub>			R <sub>L</sub> = 400 Ω, C <sub>L</sub> = 5 pF				11	ns
t <sub>PLZ</sub>							27	ns

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



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TTL Devices

**SN54LS365A, SN54LS367A  
SN74LS365A, SN74LS367A  
HEX BUS DRIVERS WITH 3-STATE OUTPUTS**

**recommended operating conditions**

	SN54LS365A SN54LS367A			SN74LS365A SN74LS367A			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage			0.7			0.8	V
I <sub>OH</sub> High-level output current			-1			-2.6	mA
I <sub>OL</sub> Low-level output current			12			24	mA
T <sub>A</sub> 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 <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-1.5			-1.5	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, I <sub>OH</sub> = MAX	2.4	3.3		2.4	3.1		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, I <sub>OL</sub> = 12 mA		0.25	0.4		0.25	0.4	V
	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 24 mA					0.35	0.5	
I <sub>OZ</sub>	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, V <sub>O</sub> = 2.4 V			20			20	μA
	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, V <sub>O</sub> = 0.4 V			-20			-20	
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V			0.1			0.1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V			20			20	μA
I <sub>IL</sub>	A Inputs	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V, Either $\bar{G}$ input at 2 V			-20		-20	μA
		V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V, Both $\bar{G}$ inputs at 0.4 V			-0.4		-0.4	
	$\bar{G}$ Inputs	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			-0.2		-0.2	mA
I <sub>OS</sub> §	V <sub>CC</sub> = MAX	-40		-225	-40		-225	mA
I <sub>CC</sub>	V <sub>CC</sub> = 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<sub>CC</sub> = 5 V, T<sub>A</sub> = 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.

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TTL Devices



**SN54LS365A, SN54LS367A**  
**SN74LS365A, SN74LS367A**  
**HEX BUS DRIVERS WITH 3-STATE OUTPUTS**

switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$  (see note 2)

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

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

**SN54LS366A, SN54LS368A  
SN74LS366A, SN74LS368A  
HEX BUS DRIVERS WITH 3-STATE OUTPUTS**

recommended operating conditions

	SN54LS366A SN54LS368A			SN74LS366A SN74LS368A			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage			0.7			0.8	V
I <sub>OH</sub> High-level output current			-1			-2.6	mA
I <sub>OL</sub> Low-level output current			12			24	mA
T <sub>A</sub> Operating free-air temperature	-55		125	0		70	°C

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

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TTL Devices

PARAMETER	TEST CONDITIONS †	SN54LS366A SN54LS368A			SN74LS366A SN74LS368A			UNIT
		MIN	TYP ‡	MAX	MIN	TYP ‡	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-1.5			-1.5	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, I <sub>OH</sub> = MAX	2.4	3.3		2.4	3.1		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, I <sub>OL</sub> = 12 mA		0.25	0.4		0.25	0.4	V
	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 24 mA					0.35	0.5	
I <sub>OZ</sub>	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, V <sub>O</sub> = 2.4 V			20			20	μA
	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, V <sub>O</sub> = 0.4 V			-20			-20	
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V			0.1			0.1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V			20			20	μA
I <sub>IL</sub>	A Inputs	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V, Either $\bar{G}$ input at 2 V			-20		-20	μA
		V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V, Both $\bar{G}$ inputs at 0.4 V			-0.4		-0.4	
	$\bar{G}$ Inputs	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			-0.2		-0.2	mA
I <sub>OS</sub> §	V <sub>CC</sub> = MAX	-40		-225	-40		-225	mA
I <sub>CC</sub>	V <sub>CC</sub> = 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<sub>CC</sub> = 5 V, T<sub>A</sub> = 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.



**SN54LS366A, SN54LS368A**  
**SN74LS366A, SN74LS368A**  
**HEX BUS DRIVERS WITH 3-STATE OUTPUTS**

switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{ C}$  (see note 2)

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

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