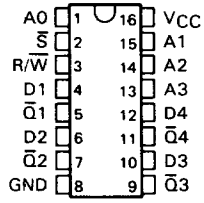
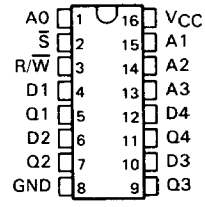
- **Organized as 16 Words of Four Bits Each**
- **Choice of Buffered 3-State or Open-Collector outputs**
- **Choice of Noninverted or Inverted Outputs**
- **Typical Access Time . . . 50 ns**

SN54LS189A, SN54LS289A . . . J PACKAGE
SN74LS189A, SN74LS289A . . . J OR N PACKAGE
(TOP VIEW)



SN54LS219A, SN54LS319A . . . J PACKAGE
SN74LS219A, SN74LS319A . . . J OR N PACKAGE
(TOP VIEW)



description

These monolithic TTL memories feature Schottky clamping for high performance and a fast chip-select access time to enhance decoding at the system level. A three-state output version and an open-collector-output version are offered for both of the logic choices. A three-state output offers the convenience of an open-collector output with the speed of a totem-pole output; it can be bus-connected to other similar outputs, yet it retains the fast rise time characteristic of the TTL totem-pole output. An open-collector output offers the capability of direct interface with a data line having a passive pull-up.

write cycle

Information to be stored in the memory is written into the selected address location when the chip-select ($\overline{S}$) and the write-enable (R/$\overline{W}$) inputs are low. While the write-enable input is low, the memory outputs are off (three-state = Hi-Z, open-collector = high). When a number of outputs are bus-connected, this off state neither loads nor drives the data bus; however, it permits the bus line to be driven by other active outputs or a passive pull-up.

read cycle

Information stored in the memory (see function table for input/output phase relationship) is available at the outputs when the write-enable input is high and the chip-select input is low. When the chip-select input is high, the outputs will be off.

FUNCTION TABLE

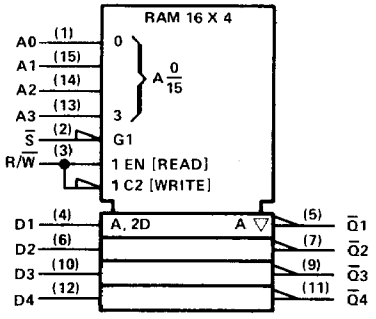
FUNCTION	INPUTS		OUTPUTS			
	CHIP SELECT	WRITE ENABLE	'LS189A	'LS289A	'LS219A	'LS319A
Write	L	L	Z	Off	Z	Off
Read	L	H	Complement of Data Entered	Complement of Data Entered	Data Entered	Data Entered
Inhibit	H	X	Z	Off	Z	Off

H = high level, L = low level, X = irrelevant, Z = high impedance

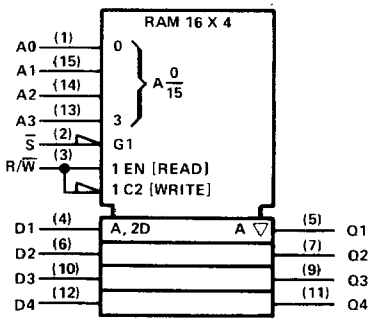
5 RAMs

logic symbols

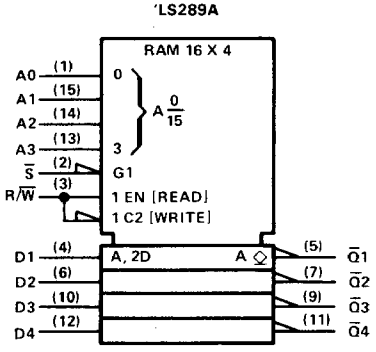
'LS189A



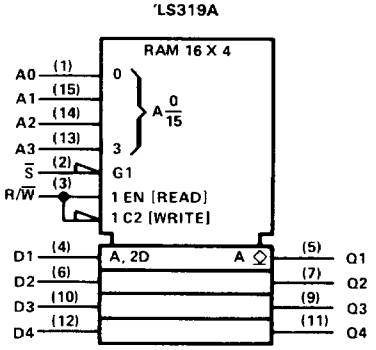
'LS219A



'LS289A

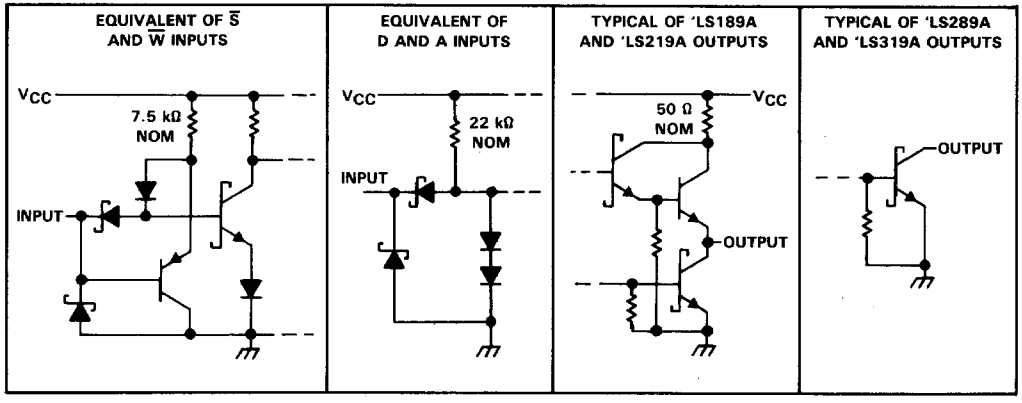


'LS319A



5 RAMs

schematics of inputs and outputs



TEXAS INSTRUMENTS
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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: 'LS189A, 'LS219A . . . . . 5.5 V
'LS289A, 'LS319A . . . . . 7 V
Operating free-air temperature range: SN54LS' Circuits . . . . . −55°C to 125°C
SN74LS' Circuits . . . . . 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

		SN54LS189A, SN54LS219A			SN74LS189A, SN74LS219A			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}				12			24	mA
Width of write pulse (write enable low), $t_{w(wr)}$		100			70			ns
Setup time	Address before write pulse, $t_{su(ad)}$	0↓			0↓			ns
	Data before end of write pulse, $t_{su(da)}$	100↓			60↓			
	Chip-select before end of write pulse, $t_{su(S)}$	100↓			60↓			
Hold time	Address after write pulse, $t_{h(ad)}$	0↑			0↑			ns
	Data after write pulse, $t_{h(da)}$	0↑			0↑			
	Chip-select after write pulse, $t_{h(S)}$	0↑			0↑			
Operating free-air temperature, T_A		−55		125	0		70	°C

↑↓The arrow indicates the transition of the write-enable input used for reference: ↑ for the low-to-high transition, ↓ for the high-to-low transition.

5
RAMs

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

PARAMETER		TEST CONDITIONS†		SN54LS189A SN54LS219A			SN74LS189A SN74LS219A			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} = MAX		2.4	3.1		2.4	3.1		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL}max	I_{OL} = 12 mA		0.25	0.4		0.25	0.4	V
			I_{OL} = 24 mA					0.35	0.5	
I_{OZH}	Off-state output current high-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_{IL} = V_{IL}max, V_O = 2.7 V				20			20	μA
I_{OZL}	Off-state output current, low-level voltage applied	V_{CC} = MAX, V_{IH} = 2 V, V_{IL} = V_{IL}max, V_O = 0.4 V				−20			−20	μA
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 7 V				100			100	μA
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		−30		−130	−30		−130	mA
I_{CC}	Supply current	V_{CC} = MAX, See Note 2			35	60		35	60	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 duration of the short circuit should not exceed one second.
NOTE 2: I_{CC} is measured with the write-enable and chip-select inputs grounded, all other inputs at 4.5 V, and all outputs open.

switching characteristics over recommended operating ranges of T_A and V_{CC} (unless otherwise noted)

PARAMETER		TEST CONDITIONS		SN54LS189A SN54LS219A			SN74LS189A SN74LS219A			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
$t_{a(ad)}$	Access time from address	C_L = 45 pF, See Note 3			50	90		50	80	ns
$t_{a(S)}$	Access time from chip select (enable time)				35	70		35	60	ns
t_{SR}	Sense recovery time				55	100		55	90	ns
t_{PXZ}	Disable time from high or low level	C_L = 5 pF, See Note 3	from $\overline{S}$		30	60		30	50	ns
			from R/$\overline{W}$		40	70		40	60	

‡All typical values are at V_{CC} = 5 V, T_A = 25°.
NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

recommended operating conditions

		SN54LS289A, SN54LS319A			SN74LS289A, SN74LS319A			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 voltage, V_{OH}				5.5			5.5	V
Low-level output current, I_{OL}				12			24	mA
Width of write pulse (write enable low), $t_{w(wr)}$		100			70			ns
Setup time	Address before write pulse, $t_{su(ad)}$	0↓			0↓			ns
	Data before end of write pulse, $t_{su(da)}$	100↓			60↓			
	Chip-select before end of write pulse, $t_{su(S)}$	100↓			60↓			
Hold time	Address after write pulse, $t_{h(ad)}$	0↑			0↑			ns
	Data after write pulse, $t_{h(da)}$	0↑			0↑			
	Chip-select after write pulse, $t_{h(S)}$	0↑			0↑			
Operating free-air temperature, T_A		−55		125	0		70	°C

‖The arrow indicates the transition of the write-enable input used for reference: ↑ for the low-to-high transition, ↓ for the high-to-low transition.

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

PARAMETER		TEST CONDITIONS†		SN54LS289A SN54LS319A			SN74LS289A SN74LS319A			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
I_{OH}	High-level output current	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL}max,	V_O = 2.4 V			20			20	μA
			V_O = 5.5 V			100			100	
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL}max	I_{OL} = 12 mA		0.25	0.4		0.25	0.4	V
			I_{OL} = 24 mA					0.35	0.5	
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 7 V				100			100	μA
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_{CC}	Supply current	V_{CC} = MAX, See Note 2			35	60		35	60	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 duration of the short circuit should not exceed one second.
NOTE 2: I_{CC} is measured with the write-enable and chip-select inputs grounded, all other inputs at 4.5 V, and all outputs open.

switching characteristics over recommended operating ranges of T_A and V_{CC} (unless otherwise noted)

PARAMETER			TEST CONDITIONS	SN54LS289A SN54LS319A			SN74LS289A SN74LS319A			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
$t_{a(ad)}$	Access time from address		C_L = 45 pF, R_L = 667Ω, See Note 3		50	90		50	80	ns
$t_{a(S)}$	Access time from chip select (enable time)				35	70		35	60	ns
t_{SR}	Sense recovery time				55	100		55	90	ns
t_{PLH}	Propagation delay time, low-to-high-level output (disable time)	from $\overline{S}$			30	60		30	50	ns
		from R/$\overline{W}$			40	70		40	60	

‡All typical values are at V_{CC} = 5 V, T_A = 25°.
NOTE 3: Load circuits and voltage waveforms are shown in Section 1.