

SDLS034

QUADRUPLE 2-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS

SN5409, SN54LS09, SN54S09,
SN7409, SN74LS09, SN74S09
DECEMBER 1983—REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

SN5409, SN54LS09, SN54S09 . . . J OR W PACKAGE
SN7409 . . . N PACKAGE
SN74LS09, SN74S09 . . . D OR N PACKAGE
(TOP VIEW)



description

These devices contain four independent 2-input AND gates. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate higher V_{OH} levels.

The SN5409, SN54LS09, and SN54S09 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN7409, SN74LS09, and SN74S09 are characterized for operation from 0°C to 70°C .

SN54LS09, SN54S09 . . . FK PACKAGE
(TOP VIEW)



NC—No internal connection

FUNCTION TABLE (each gate)

INPUTS		OUTPUT
A	B	Y
H	H	H
L	X	L
X	L	L

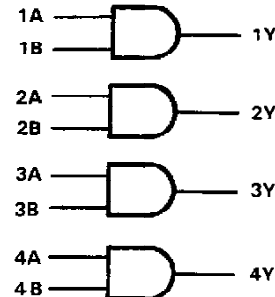
logic symbol



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

logic diagram (positive logic)



$$Y = A \cdot B \text{ or } Y = \overline{\overline{A} + \overline{B}}$$

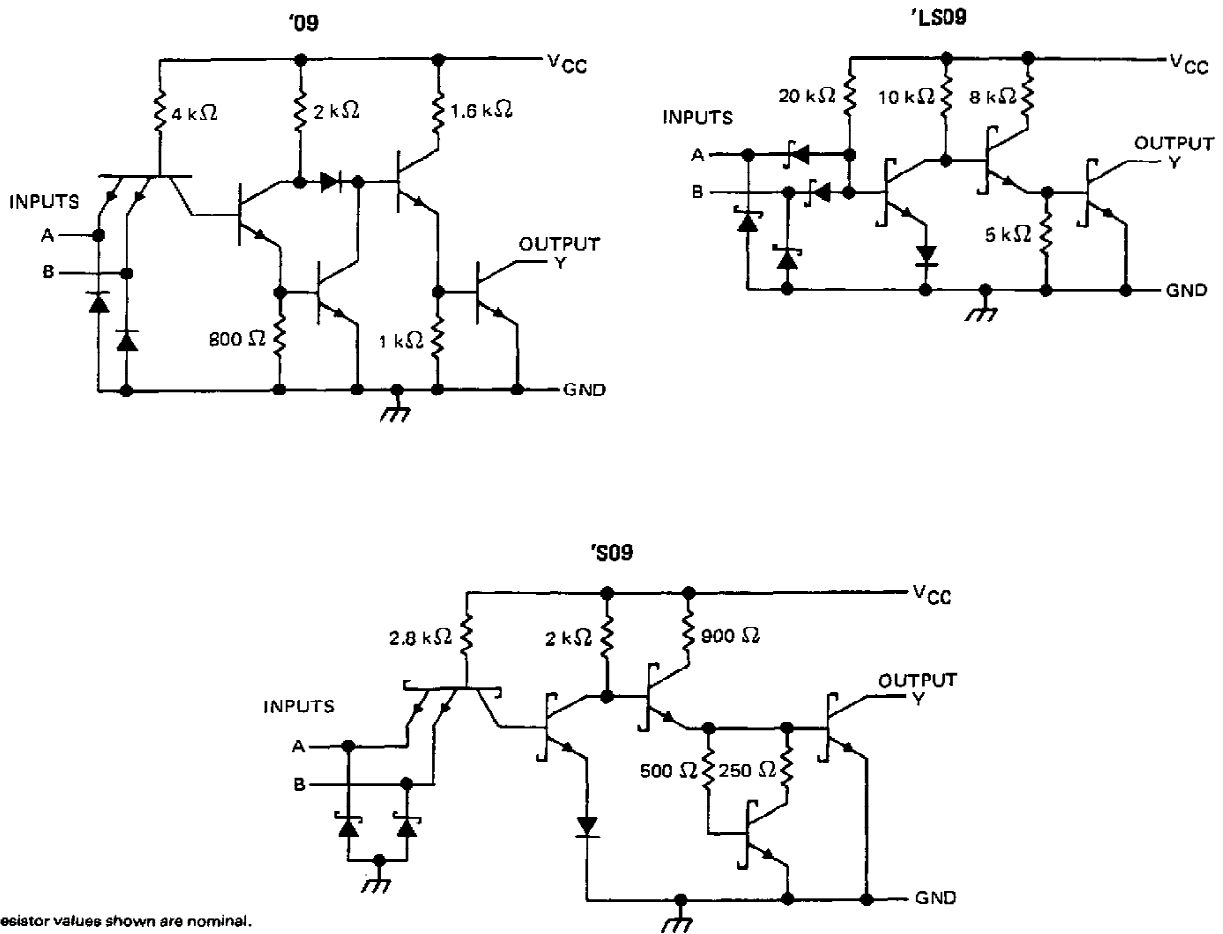
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**SN5409, SN54LS09, SN54S09,
SN7409, SN74LS09, SN74S09
QUADRUPLE 2-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS**

schematics (each gate)



Resistor values shown are nominal.

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage: '09, 'S09	5.5 V
'LS09	7 V
Off-state output voltage	7 V
Operating free-air temperature range: 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.

**TEXAS
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SN5409, SN7409
QUADRUPLE 2-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS

recommended operating conditions

	SN5409			SN7409			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			V
V_{OH} High-level output voltage				5.5			V
I_{OL} Low-level output current				16			mA
T_A Operating free-air temperature	-55			125			$^{\circ}$ C

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

PARAMETER	TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
V_{IK}	$V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$		-1.5		V
I_{OH}	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{OH} = 5.5 \text{ V}$		0.25		mA
V_{OL}	$V_{CC} = \text{MIN}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 16 \text{ mA}$	0.2	0.4		V
I_I	$V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$		1		mA
I_{IH}	$V_{CC} = \text{MAX}$, $V_I = 2.4 \text{ V}$		40		μ A
I_{IL}	$V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$		-1.6		mA
I_{CCH}	$V_{CC} = \text{MAX}$, $V_I = 4.5 \text{ V}$		11	21	mA
I_{CCL}	$V_{CC} = \text{MAX}$, $V_I = 0 \text{ V}$		20	33	mA

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

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

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}	A or B	Y	$R_L = 400 \Omega$, $C_L = 15 \text{ pF}$		21	32	ns
t_{PHL}					16	24	ns

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



SN54LS09, SN74LS09 QUADRUPLE 2-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS

recommended operating conditions

	SN54LS09			SN74LS09			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
V _{OH} High-level output voltage			5.5			5.5	V
I _{OL} Low-level output current			4			8	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†	SN54LS09			SN74LS09			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IK}	V _{CC} = MIN, I _I = -18 mA			-1.5			-1.5	V
I _{OH}	V _{CC} = MIN, V _{IH} = 2 V, V _{OH} = 5.5 V			0.1			0.1	mA
V _{OL}	V _{CC} = MIN, V _{IL} = MAX, I _{OL} = 4 mA		0.25	0.4		0.25	0.4	V
	V _{CC} = MIN, V _{IL} = MAX, I _{OL} = 8 mA					0.35	0.5	
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}	V _{CC} = MAX, V _I = 0.4 V			-0.4			-0.4	mA
I _{CCH}	V _{CC} = MAX, V _I = 4.5 V		2.4	4.8		2.4	4.8	mA
I _{CCL}	V _{CC} = MAX, V _I = 0 V		4.4	8.8		4.4	8.8	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.

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}	A or B	Y	R _L = 2 kΩ, C _L = 15 pF		20	35	ns
t _{PHL}					17	35	ns

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

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SN54S09, SN74S09
QUADRUPLE 2-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS

recommended operating conditions

	SN54S09			SN74S09			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
V _{OH} High-level output voltage			5.5			5.5	V
I _{OL} Low-level output current			20			20	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†	MIN	TYP‡	MAX	UNIT	
V _{IK}	V _{CC} = MIN, I _I = -18 mA			-1.2	V	
I _{OH}	V _{CC} = MIN, V _{IH} = 2 V, V _{OH} = 5.5 V			0.25	mA	
V _{OL}	V _{CC} = MIN, V _{IL} = 0.8 V, I _{OL} = 20 mA			0.5	V	
I _I	V _{CC} = MAX, V _I = 5.5 V			1	mA	
I _{IH}	V _{CC} = MAX, V _I = 2.7 V			50	μA	
I _{IL}	V _{CC} = MAX, V _I = 0.5 V			-2	mA	
I _{CCH}	V _{CC} = MAX, V _I = 4.5 V			18	32	mA
I _{CCL}	V _{CC} = MAX, V _I = 0 V			32	57	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.

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}	A or B	Y	R _L = 280 Ω, C _L = 15 pF	6.5	10		ns
t _{PHL}				6.5	10		ns
t _{PLH}			R _L = 280 Ω, C _L = 50 pF	9			ns
t _{PHL}				9			ns

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



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