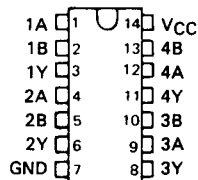


SN5409, SN54LS09, SN54S09, SN7409, SN74LS09, SN74S09 QUADRUPLE 2-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS

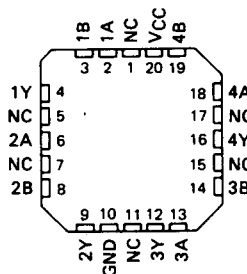
DECEMBER 1983—REVISED MARCH 1988

- 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)



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



NC—No internal connection

description

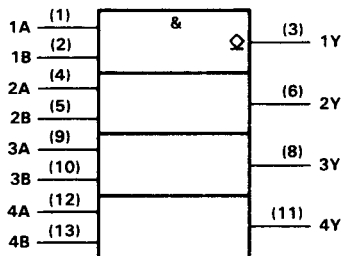
These devices contain four independent 2-input AND gates. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate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

FUNCTION TABLE (each gate)

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

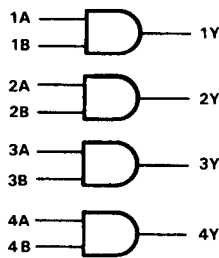
logic symbol



† 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)



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

2

TTL Devices

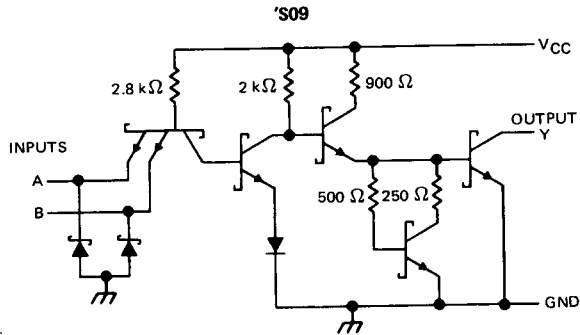
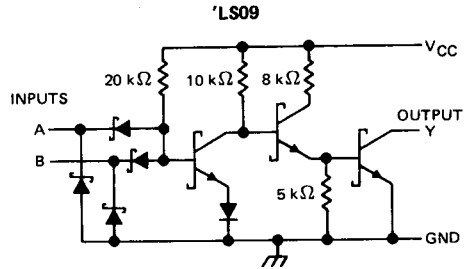
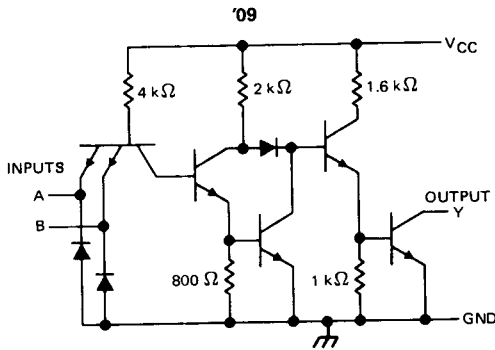
PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

**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 (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.

2

TTL Devices

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.

2

TTL Devices

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			0.25	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			2.4	4.8	mA
I _{CCL}	V _{CC} = MAX, V _I = 0 V			4.4			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.

2
TTL Devices

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.

2
TTL Devices