

# SN54LS21, SN74LS21 DUAL 4-INPUT POSITIVE-AND GATES

SDLS139 – APRIL 1985 – 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

## description

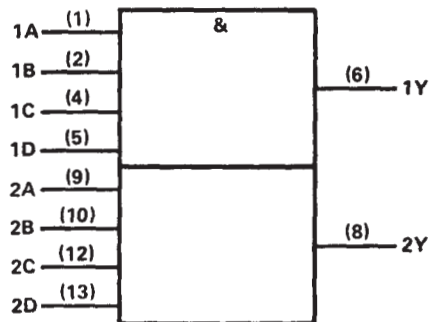
These devices contain two independent 4-input AND gates.

The SN54LS21 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74LS21 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE (each gate)

INPUTS				OUTPUT
A	B	C	D	Y
H	H	H	H	H
L	X	X	X	L
X	L	X	X	L
X	X	L	X	L
X	X	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.

SN54LS21 . . . J OR W PACKAGE  
SN74LS21 . . . D OR N PACKAGE  
(TOP VIEW)



SN54LS21 . . . FK PACKAGE  
(TOP VIEW)



NC—No internal connection

## logic diagram

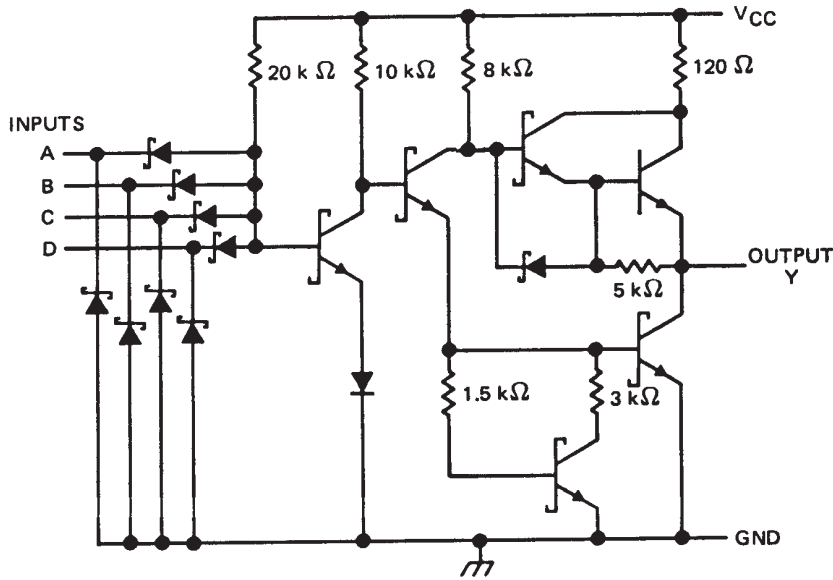


(positive logic)  $Y = A \cdot B \cdot C \cdot D$  or  $Y = \overline{\overline{A} + \overline{B} + \overline{C} + \overline{D}}$

# SN54LS21, SN74LS21 DUAL 4-INPUT POSITIVE-AND GATES

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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 .....	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 terminals.



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# SN54LS21, SN74LS21 DUAL 4-INPUT POSITIVE-AND GATES

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## recommended operating conditions

	SN54LS21			SN74LS21			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			-0.4			-0.4	mA
$I_{OL}$ 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 †	SN54LS21			SN74LS21			UNIT
		MIN	TYP ‡	MAX	MIN	TYP ‡	MAX	
$V_{IK}$	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$			-1.5			-1.5	V
$V_{OH}$	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OH} = -0.4 \text{ mA}$	2.5	3.4		2.7	3.4		V
$V_{OL}$	$V_{CC} = \text{MIN}, V_{IL} = \text{MAX}, I_{OL} = 4 \text{ mA}$		0.25	0.4		0.25	0.4	V
	$V_{CC} = \text{MIN}, V_{IL} = \text{MAX}, I_{OL} = 8 \text{ mA}$					0.35	0.5	
$I_I$	$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$			0.1			0.1	mA
$I_{IH}$	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$			20			20	μA
$I_{IL}$	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$			-0.4			-0.4	mA
$I_{OS} §$	$V_{CC} = \text{MAX}$	-20		-100	-20		-100	mA
$I_{CCH}$	$V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$		1.2	2.4		1.2	2.4	mA
$I_{CCL}$	$V_{CC} = \text{MAX}, V_I = 0 \text{ V}$		2.2	4.4		2.2	4.4	mA

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

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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	Any	Y	$R_L = 2 \text{ k}\Omega, C_L = 15 \text{ pF}$		8	15	ns
$t_{PHL}$					10	20	ns

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



## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
JM38510/31003B2A	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 31003B2A	<a href="#">Samples</a>
JM38510/31003BCA	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 31003BCA	<a href="#">Samples</a>
JM38510/31003BDA	ACTIVE	CFP	W	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 31003BDA	<a href="#">Samples</a>
M38510/31003B2A	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 31003B2A	<a href="#">Samples</a>
M38510/31003BCA	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 31003BCA	<a href="#">Samples</a>
M38510/31003BDA	ACTIVE	CFP	W	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 31003BDA	<a href="#">Samples</a>
SN54LS21J	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SN54LS21J	<a href="#">Samples</a>
SN74LS21D	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	0 to 70	LS21	
SN74LS21DR	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS21	<a href="#">Samples</a>
SN74LS21N	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74LS21N	<a href="#">Samples</a>
SN74LS21NE4	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74LS21N	<a href="#">Samples</a>
SN74LS21NSR	ACTIVE	SOP	NS	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS21	<a href="#">Samples</a>
SNJ54LS21FK	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SNJ54LS 21FK	<a href="#">Samples</a>
SNJ54LS21J	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SNJ54LS21J	<a href="#">Samples</a>
SNJ54LS21W	ACTIVE	CFP	W	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SNJ54LS21W	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of  $\leq 1000$ ppm threshold. Antimony trioxide based flame retardants must also meet the  $\leq 1000$ ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**OTHER QUALIFIED VERSIONS OF SN54LS21, SN74LS21 :**

● Catalog : [SN74LS21](#)

● Military : [SN54LS21](#)

NOTE: Qualified Version Definitions:

● Catalog - TI's standard catalog product

● Military - QML certified for Military and Defense Applications

**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS21DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74LS21NSR	SOP	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS21DR	SOIC	D	14	2500	356.0	356.0	35.0
SN74LS21NSR	SOP	NS	14	2000	356.0	356.0	35.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
JM38510/31003B2A	FK	LCCC	20	55	506.98	12.06	2030	NA
JM38510/31003BDA	W	CFP	14	25	506.98	26.16	6220	NA
M38510/31003B2A	FK	LCCC	20	55	506.98	12.06	2030	NA
M38510/31003BDA	W	CFP	14	25	506.98	26.16	6220	NA
SN74LS21N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS21N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS21NE4	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS21NE4	N	PDIP	14	25	506	13.97	11230	4.32
SNJ54LS21FK	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54LS21W	W	CFP	14	25	506.98	26.16	6220	NA





# D0014A

# PACKAGE OUTLINE

## SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4220718/A 09/2016

### NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm, per side.
5. Reference JEDEC registration MS-012, variation AB.

# EXAMPLE BOARD LAYOUT

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
SCALE:8X



SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:8X

4220718/A 09/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within MIL STD 1835 GDFP1-F14

## GENERIC PACKAGE VIEW

**FK 20**

**LCCC - 2.03 mm max height**

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



4229370VA\

J 14

**GENERIC PACKAGE VIEW**  
**CDIP - 5.08 mm max height**  
CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

4040083-5/G

J0014A



# PACKAGE OUTLINE

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

**NOTES:**

1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.



# EXAMPLE BOARD LAYOUT

J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



LAND PATTERN EXAMPLE  
NON-SOLDER MASK DEFINED  
SCALE: 5X



4214771/A 05/2017

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

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