

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

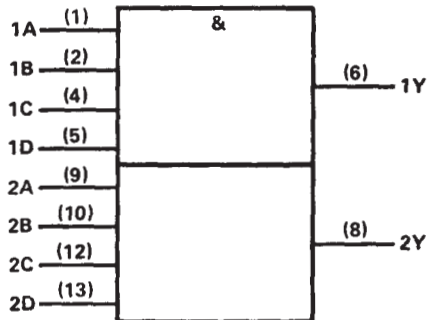
These devices contain two independent 4-input AND gates.

The SN54LS21 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74LS21 is characterized for operation from 0°C to 70°C .

FUNCTION TABLE (each gate)

| INPUTS | | | | OUTPUT Y |
|--------|---|---|---|-------------|
| A | B | C | D | |
| 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 |

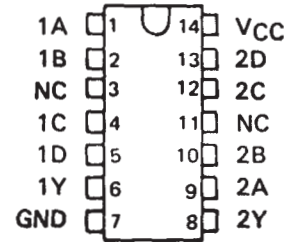
logic symbol†



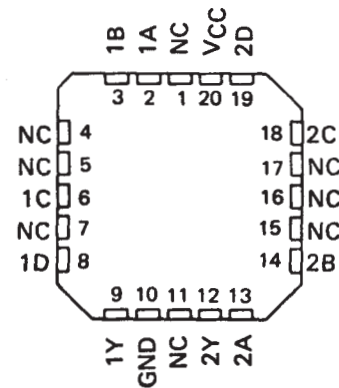
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

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

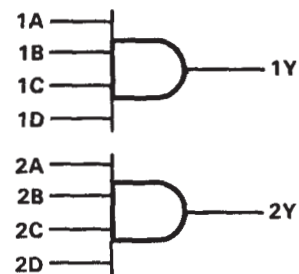


SN54LS21 . . . FK PACKAGE
(TOP VIEW)



NC—No internal connection

logic diagram

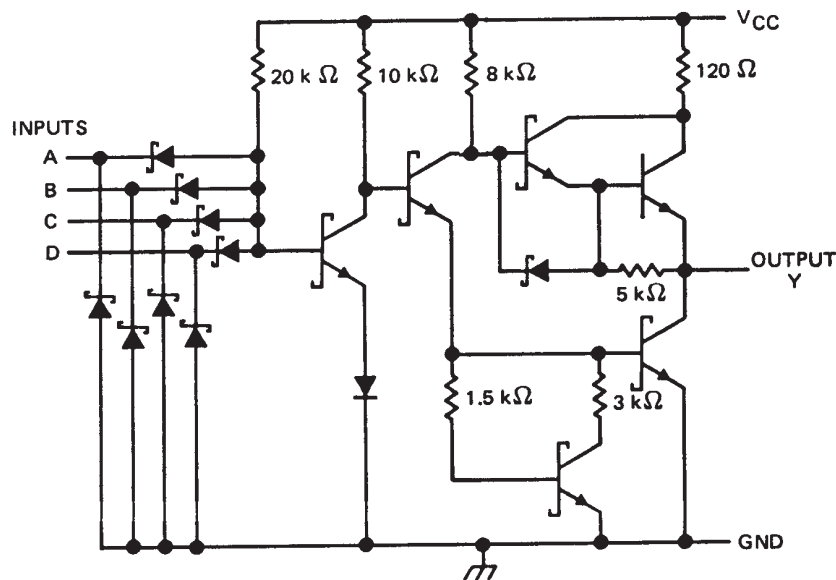


(positive logic) $Y = A \cdot B \cdot C \cdot D$ or $Y = \overline{A} + \overline{B} + \overline{C} + \overline{D}$

SN54LS21, SN74LS21
DUAL 4-INPUT POSITIVE-AND GATES

SDLS139 – APRIL 1985 – REVISED MARCH 1988

schematics (each gate)



Resistor values shown are nominal.

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

| | |
|---|----------------|
| Supply voltage, VCC (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.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN54LS21, SN74LS21 DUAL 4-INPUT POSITIVE-AND GATES

SDLS139 – APRIL 1985 – REVISED MARCH 1988

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 part number | Status (1) | Material type (2) | Package Pins | Package qty Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|----------------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|----------------------|
| JM38510/31003B2A | Active | Production | LCCC (FK) 20 | 55 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | JM38510/ 31003B2A |
| JM38510/31003B2A.A | Active | Production | LCCC (FK) 20 | 55 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | JM38510/ 31003B2A |
| JM38510/31003BCA | Active | Production | CDIP (J) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | JM38510/ 31003BCA |
| JM38510/31003BCA.A | Active | Production | CDIP (J) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | JM38510/ 31003BCA |
| JM38510/31003BDA | Active | Production | CFP (W) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | JM38510/ 31003BDA |
| JM38510/31003BDA.A | Active | Production | CFP (W) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | JM38510/ 31003BDA |
| M38510/31003B2A | Active | Production | LCCC (FK) 20 | 55 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | JM38510/ 31003B2A |
| M38510/31003BCA | Active | Production | CDIP (J) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | JM38510/ 31003BCA |
| M38510/31003BDA | Active | Production | CFP (W) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | JM38510/ 31003BDA |
| SN54LS21J | Active | Production | CDIP (J) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | SN54LS21J |
| SN54LS21J.A | Active | Production | CDIP (J) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | SN54LS21J |
| SN74LS21D | Obsolete | Production | SOIC (D) 14 | - | - | Call TI | Call TI | 0 to 70 | LS21 |
| SN74LS21DR | Active | Production | SOIC (D) 14 | 2500 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS21 |
| SN74LS21DR.A | Active | Production | SOIC (D) 14 | 2500 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS21 |
| SN74LS21N | Active | Production | PDIP (N) 14 | 25 TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | SN74LS21N |
| SN74LS21N.A | Active | Production | PDIP (N) 14 | 25 TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | SN74LS21N |
| SN74LS21NE4 | Active | Production | PDIP (N) 14 | 25 TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | SN74LS21N |
| SN74LS21NSR | Active | Production | SOP (NS) 14 | 2000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 74LS21 |
| SN74LS21NSR.A | Active | Production | SOP (NS) 14 | 2000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 74LS21 |
| SNJ54LS21FK | Active | Production | LCCC (FK) 20 | 55 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | SNJ54LS 21FK |
| SNJ54LS21FK.A | Active | Production | LCCC (FK) 20 | 55 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | SNJ54LS 21FK |

| Orderable part number | Status (1) | Material type (2) | Package Pins | Package qty Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|----------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| SNJ54LS21J | Active | Production | CDIP (J) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | SNJ54LS21J |
| SNJ54LS21J.A | Active | Production | CDIP (J) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | SNJ54LS21J |
| SNJ54LS21W | Active | Production | CFP (W) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | SNJ54LS21W |
| SNJ54LS21W.A | Active | Production | CFP (W) 14 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | SNJ54LS21W |

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts 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.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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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



*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 | 8.1 | 10.4 | 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 | 353.0 | 353.0 | 32.0 |
| SN74LS21NSR | SOP | NS | 14 | 2000 | 353.0 | 353.0 | 32.0 |

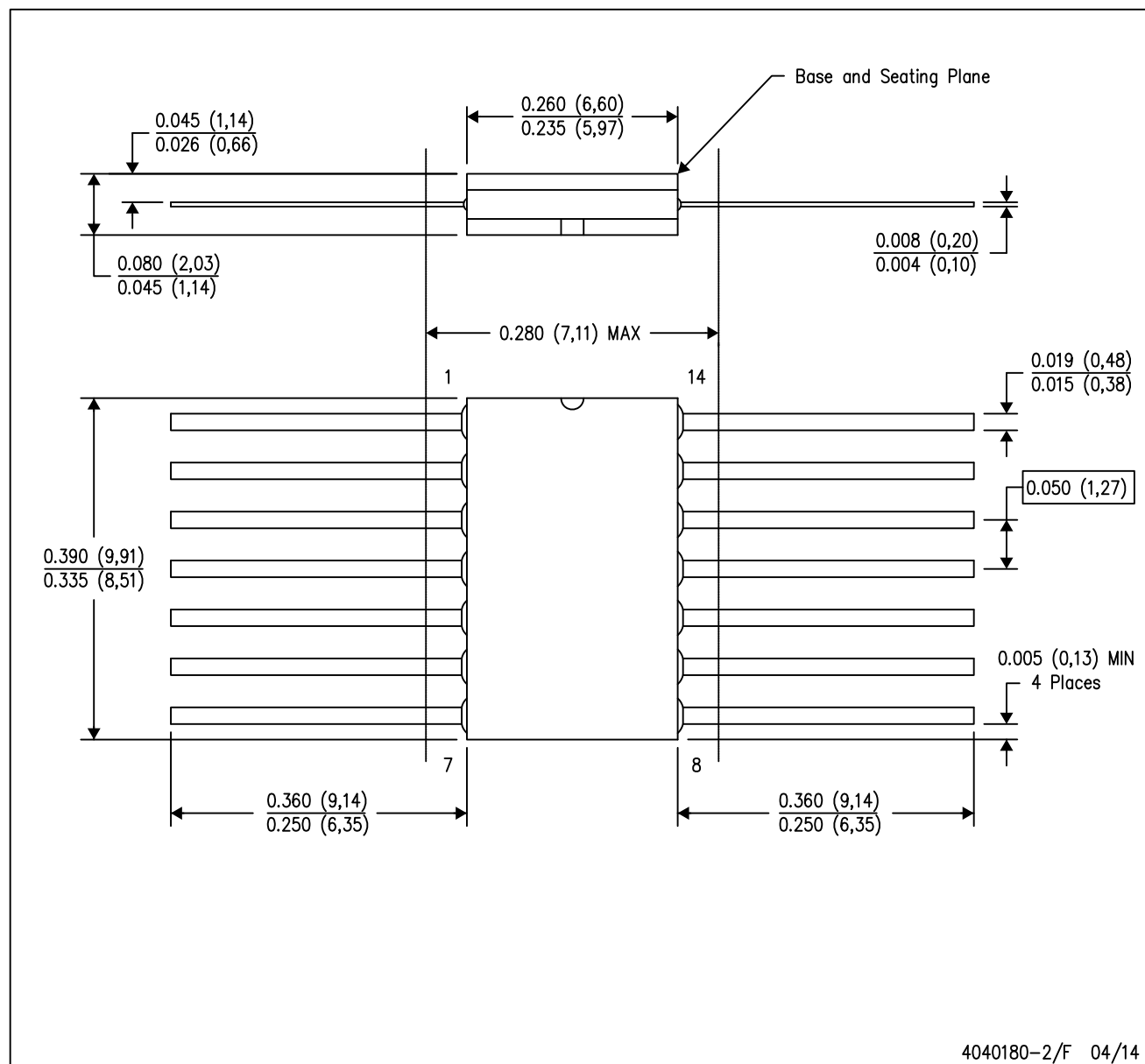
TUBE


*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 |
| JM38510/31003B2A.A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| JM38510/31003BDA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| JM38510/31003BDA.A | 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 |
| SN74LS21N.A | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74LS21N.A | 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 |
| SNJ54LS21FK.A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| SNJ54LS21W | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| SNJ54LS21W.A | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |

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.



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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

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

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



| PINS ** | 14 | 16 | 18 | 20 |
|---------------------|------------------|------------------|------------------|------------------|
| DIM | | | | |
| A MAX | 0.775 (19,69) | 0.775 (19,69) | 0.920 (23,37) | 1.060 (26,92) |
| A MIN | 0.745 (18,92) | 0.745 (18,92) | 0.850 (21,59) | 0.940 (23,88) |
| MS-001 VARIATION | AA | BB | AC | AD |



14/18 Pin Only
20 Pin vendor option

4040049/E 12/2002

- 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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