

SN5473, SN54LS73A, SN7473, SN74LS73A DUAL J-K FLIP-FLOPS WITH CLEAR

SDLS118 – DECEMBER 1983 – REVISED MARCH 1988

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

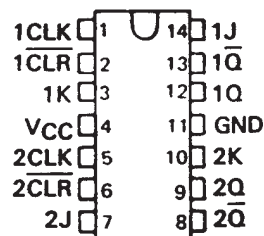
description

The '73, and 'H73, contain two independent J-K flip-flops with individual J-K, clock, and direct clear inputs. The '73, and 'H73, are positive pulse-triggered flip-flops. J-K input is loaded into the master while the clock is high and transferred to the slave on the high-to-low transition. For these devices the J and K inputs must be stable while the clock is high.

The 'LS73A contains two independent negative-edge-triggered flip-flops. The J and K inputs must be stable one setup time prior to the high-to-low clock transition for predictable operation. When the clear is low, it overrides the clock and data inputs forcing the Q output low and the \bar{Q} output high.

The SN5473, SN54H73, and the SN54LS73A are characterized for operation over the full military temperature range of -55°C to 125°C . The SN7473, and the SN74LS73A are characterized for operation from 0°C to 70°C .

SN5473, SN54LS73A . . . J OR W PACKAGE
SN7473 . . . N PACKAGE
SN74LS73A . . . D OR N PACKAGE
(TOP VIEW)



'73
FUNCTION TABLE

| INPUTS | | | | OUTPUTS | |
|--------|-----|---|---|----------------|-------------|
| CLR | CLK | J | K | Q | \bar{Q} |
| L | X | X | X | L | H |
| H | | L | L | Q ₀ | \bar{Q}_0 |
| H | | H | L | H | L |
| H | | L | H | L | H |
| H | | H | H | TOGGLE | |

'LS73A
FUNCTION TABLE

| INPUTS | | | | OUTPUTS | |
|--------|-----|---|---|----------------|-------------|
| CLR | CLK | J | K | Q | \bar{Q} |
| L | X | X | X | L | H |
| H | | L | L | Q ₀ | \bar{Q}_0 |
| H | | H | L | H | L |
| H | | L | H | L | H |
| H | | H | H | TOGGLE | |
| H | H | X | X | Q ₀ | \bar{Q}_0 |

FOR CHIP CARRIER INFORMATION,
CONTACT THE FACTORY

SN5473, SN54LS73A, SN7473, SN74LS73A DUAL J-K FLIP-FLOPS WITH CLEAR

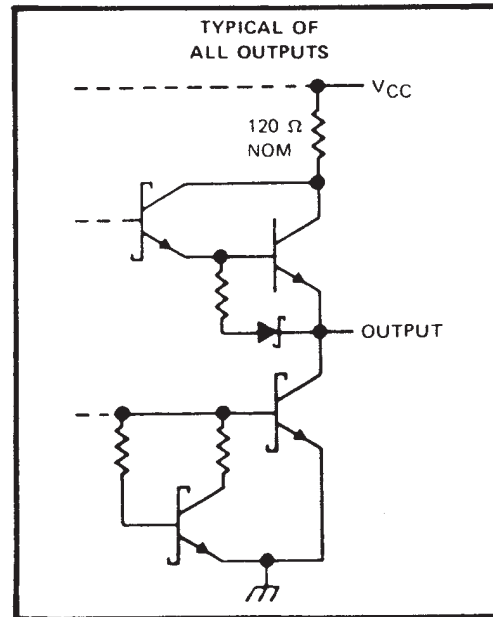
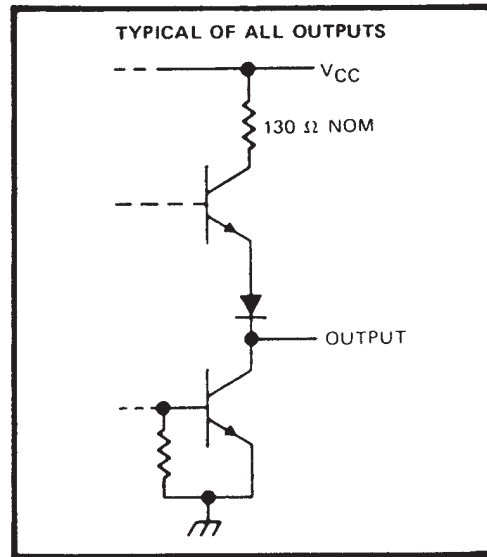
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logic symbols†



†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

schematics of inputs and outputs



SN5473, SN54LS73A, SN7473, SN74LS73A DUAL J-K FLIP-FLOPS WITH CLEAR

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logic diagrams (positive logic)



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

| | |
|---|----------------|
| Supply voltage, V_{CC} (See Note 1) | 7 V |
| Input voltage: '73 | 5.5 V |
| 'LS73A | 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.



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SN5473, SN54LS73A, SN7473, SN74LS73A DUAL J-K FLIP-FLOPS WITH CLEAR

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recommended operating conditions

| | | SN5473 | | | SN7473 | | | 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 | |
| I_{OH} | High-level output current | | | -0.4 | | | -0.4 | mA | |
| I_{OL} | Low-level output current | | | 16 | | | 16 | mA | |
| t_w | Pulse duration | CLK high | | 20 | | | 20 | ns | |
| | | CLK low | | 47 | | | 47 | | |
| | | \overline{CLR} low | | 25 | | | 25 | | |
| t_{su} | Input setup time before CLK \uparrow | | | 0 | | | 0 | ns | |
| t_h | Input hold time data after CLK \downarrow | | | 0 | | | 0 | ns | |
| T_A | Operating free-air temperature | | | -55 | | 125 | 0 | 70 | $^{\circ}C$ |

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

| PARAMETER | TEST CONDITIONS [†] | SN5473 | | | SN7473 | | | UNIT |
|-----------------------|--|--------|------------------|------|--------|------------------|------|---------------|
| | | MIN | TYP [‡] | MAX | MIN | TYP [‡] | MAX | |
| V_{IK} | $V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$ | | | -1.5 | | | -1.5 | V |
| V_{OH} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OH} = -0.4 \text{ mA}$ | 2.4 | 3.4 | | 2.4 | 3.4 | | V |
| V_{OL} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 16 \text{ mA}$ | | 0.2 | 0.4 | | 0.2 | 0.4 | V |
| I_I | $V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$ | | | 1 | | | 1 | mA |
| I_{IH} | J or K | | | 40 | | | 40 | μA |
| | \overline{CLR} or CLK | | | 80 | | | 80 | |
| I_{IL} | J or K | | | -1.6 | | | -1.6 | mA |
| | \overline{CLR} | | | -3.2 | | | -3.2 | |
| | CLK | | | -3.2 | | | -3.2 | |
| I_{OS} [§] | $V_{CC} = \text{MAX}$ | -20 | | -57 | -18 | | -57 | mA |
| I_{CC} [¶] | $V_{CC} = \text{MAX}$, See Note 2 | | 10 | 20 | | 10 | 20 | mA |

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

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

[§] Not more than one output should be shorted at a time.

[¶] Average per flip-flop.

NOTE 2: With all outputs open, I_{CC} is measured with the Q and \overline{Q} outputs high in turn. At the time of measurement, the clock input is grounded.

switching characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^{\circ}C$ (see note 3)

| PARAMETER# | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------|------------------|---------------------|--|-----|-----|-----|------|
| f_{max} | | | | 15 | 20 | | MHz |
| t_{PLH} | \overline{CLR} | \overline{Q} | $R_L = 400 \Omega$, $C_L = 15 \text{ pF}$ | | 16 | 25 | ns |
| t_{PHL} | | Q | | | 25 | 40 | ns |
| t_{PLH} | CLK | Q or \overline{Q} | | | 16 | 25 | ns |
| t_{PHL} | | | | | 25 | 40 | ns |

f_{max} = maximum clock frequency; t_{PLH} = propagation delay time, low-to-high-level output; t_{PHL} = propagation delay time, high-to-low-level output.

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



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recommended operating conditions

| | | SN54LS73A | | | SN74LS73A | | | 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 |
| f_{clock} | Clock frequency | 0 | | 30 | 0 | | 30 | MHz |
| t_w | Pulse duration | CLK high | | 20 | 20 | | ns | |
| | | CLR low | | 25 | 20 | | | |
| t_{su} | Set up time-before CLK ↓ | data high or low | | 20 | 20 | | ns | |
| | | CLR inactive | | 20 | 20 | | | |
| t_h | Hold time-data after CLK ↓ | 0 | | | 0 | | | ns |
| 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† | SN54LS73A | | | SN74LS73A | | | 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} | $V_{CC} = \text{MIN}$, $I_{OH} = -0.4 \text{ mA}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = \text{MAX}$ | 2.5 | 3.4 | | 2.7 | 3.4 | | V |
| V_{OL} | $V_{CC} = \text{MIN}$, $I_{OL} = 4 \text{ mA}$, $V_{IL} = \text{MAX}$, $V_{IH} = 2 \text{ V}$ | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | $V_{CC} = \text{MIN}$, $I_{OL} = 8 \text{ mA}$, $V_{IL} = \text{MAX}$, $V_{IH} = 2 \text{ V}$ | | | | | 0.35 | 0.5 | |
| I_I | J or K | | | 0.1 | | | 0.1 | mA |
| | CLR | $V_{CC} = \text{MAX}$, $V_I = 7 \text{ V}$ | | 0.3 | | | 0.3 | |
| | CLK | | | 0.4 | | | 0.4 | |
| I_{IH} | J or K | $V_{CC} = \text{MAX}$, $V_I = 2.7 \text{ V}$ | | 20 | | | 20 | μA |
| | CLR | | | 60 | | | 60 | |
| | CLK | | | 80 | | | 80 | |
| I_{IL} | J or K | $V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$ | | -0.4 | | | -0.4 | mA |
| | CLR or CLK | | | -0.8 | | | -0.8 | |
| $I_{OS}§$ | $V_{CC} = \text{MAX}$, See Note 4 | -20 | | -100 | -20 | | -100 | mA |
| $I_{CC} \text{ (Total)}$ | $V_{CC} = \text{MAX}$, See Note 2 | | 4 | 6 | | 4 | 6 | 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.

NOTE 2: With all outputs open, I_{CC} is measured with the Q and \bar{Q} outputs high in turn. At the time of measurement, the clock input is grounded.

NOTE 4: For certain devices where state commutation can be caused by shorting an output to ground, an equivalent test may be performed with $V_O = 2.25 \text{ V}$ and 2.125 V for the 54 family and the 74 family, respectively, with the minimum and maximum limits reduced to one half of their stated values.

switching characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$ (see note 3)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------|--------------|----------------|--|-----|-----|-----|------|
| f_{max} | | | | 30 | 45 | | MHz |
| t_{PLH} | CLR or CLK | Q or \bar{Q} | $R_L = 2 \text{ k}\Omega$, $C_L = 15 \text{ pF}$ | | 15 | 20 | ns |
| t_{PHL} | | | | | 15 | 20 | ns |

NOTE 3: 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/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|------------------------------------|-------------------------|
| 5962-9675101QCA | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9675101QC A SNJ54LS73AJ | Samples |
| 5962-9675101QDA | ACTIVE | CFP | W | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9675101QD A SNJ54LS73AW | Samples |
| 5962-9675101QDA | ACTIVE | CFP | W | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9675101QD A SNJ54LS73AW | Samples |
| SN54LS73AJ | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | SN54LS73AJ | Samples |
| SN54LS73AJ | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | SN54LS73AJ | Samples |
| SN74LS73AD | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS73A | Samples |
| SN74LS73AD | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS73A | Samples |
| SN74LS73ADR | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS73A | Samples |
| SN74LS73ADR | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS73A | Samples |
| SN74LS73ADRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS73A | Samples |
| SN74LS73ADRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS73A | Samples |
| SN74LS73AN | ACTIVE | PDIP | N | 14 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS73AN | Samples |
| SN74LS73AN | ACTIVE | PDIP | N | 14 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS73AN | Samples |
| SN74LS73ANE4 | ACTIVE | PDIP | N | 14 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS73AN | Samples |
| SN74LS73ANE4 | ACTIVE | PDIP | N | 14 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS73AN | Samples |
| SNJ54LS73AJ | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9675101QC A SNJ54LS73AJ | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|-------------------------|----------------------|--------------|------------------------------------|-------------------------|
| SNJ54LS73AJ | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9675101QC A SNJ54LS73AJ | Samples |
| SNJ54LS73AW | ACTIVE | CFP | W | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9675101QD A SNJ54LS73AW | Samples |
| SNJ54LS73AW | ACTIVE | CFP | W | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9675101QD A SNJ54LS73AW | Samples |

(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.

OBSELETE: 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 <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm 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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF SN54LS73A, SN74LS73A :

- Catalog: [SN74LS73A](#)
- Military: [SN54LS73A](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


| | |
|----|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS73ADR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 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) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS73ADR | SOIC | D | 14 | 2500 | 367.0 | 367.0 | 38.0 |

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

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

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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.
 - C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - D The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

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