

SN54AC373, SN74AC373 OCTAL D-TYPE TRANSPARENT LATCHES WITH 3-STATE OUTPUTS

SCAS540D – OCTOBER 1995 – REVISED OCTOBER 2003

- 2-V to 6-V V_{CC} Operation
- Inputs Accept Voltages to 6 V
- Max t_{pd} of 9.5 ns at 5 V
- 3-State Noninverting Outputs Drive Bus Lines Directly
- Full Parallel Access for Loading

description/ordering information

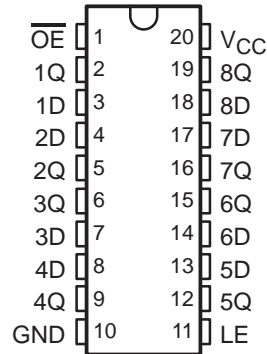
These 8-bit latches feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. The devices are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The eight latches are D-type transparent latches. When the latch-enable (LE) input is high, the Q outputs follow the data (D) inputs. When LE is taken low, the Q outputs are latched at the logic levels set up at the D inputs.

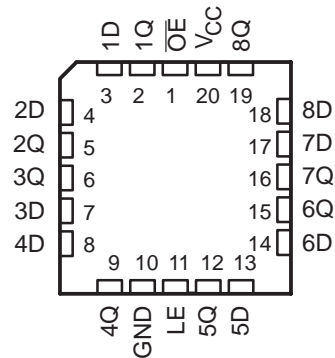
A buffered output-enable (\overline{OE}) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines in bus-organized systems without need for interface or pullup components.

\overline{OE} does not affect the internal operations of the latches. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

SN54AC373 . . . J OR W PACKAGE
SN74AC373 . . . DB, DW, N, NS, OR PW PACKAGE
(TOP VIEW)



SN54AC373 . . . FK PACKAGE
(TOP VIEW)



ORDERING INFORMATION

| T_A | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------|---------------|-----------------------|------------------|
| -40°C to 85°C | PDIP – N | Tube | SN74AC373N | SN74AC373N |
| | SOIC – DW | Tube | SN74AC373DW | AC373 |
| | | Tape and reel | SN74AC373DWR | |
| | SOP – NS | Tape and reel | SN74AC373NSR | AC373 |
| | SSOP – DB | Tape and reel | SN74AC373DBR | AC373 |
| | TSSOP – PW | Tube | SN74AC373PW | AC373 |
| Tape and reel | | SN74AC373PWR | | |
| -55°C to 125°C | CDIP – J | Tube | SNJ54AC373J | SNJ54AC373J |
| | CFP – W | Tube | SNJ54AC373W | SNJ54AC373W |
| | LCCC – FK | Tube | SNJ54AC373FK | SNJ54AC373FK |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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PRODUCTION DATA information is 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**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

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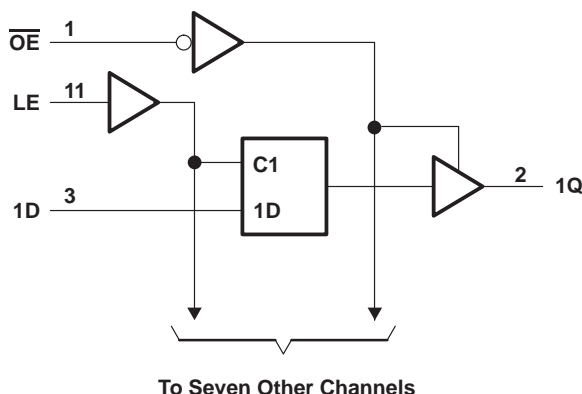
description/ordering information (continued)

To ensure the high-impedance state during power up or power down, \overline{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

FUNCTION TABLE
(each latch)

| INPUTS | | | OUTPUT |
|-----------------|----|---|--------|
| \overline{OE} | LE | D | Q |
| L | H | H | H |
| L | H | L | L |
| L | L | X | Q_0 |
| H | X | X | Z |

logic diagram (positive logic)



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

| | |
|--|----------------------------|
| Supply voltage range, V_{CC} | -0.5 V to 7 V |
| Input voltage range, V_I (see Note 1) | -0.5 V to $V_{CC} + 0.5$ V |
| Output voltage range, V_O (see Note 1) | -0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) | ± 20 mA |
| Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) | ± 20 mA |
| Continuous output current, I_O ($V_O = 0$ to V_{CC}) | ± 50 mA |
| Continuous current through V_{CC} or GND | ± 200 mA |
| Package thermal impedance, θ_{JA} (see Note 2): | |
| DB package | 70°C/W |
| DW package | 58°C/W |
| N package | 69°C/W |
| NS package | 60°C/W |
| PW package | 83°C/W |
| Storage temperature range, T_{stg} | -65°C to 150°C |

[†] Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

SN54AC373, SN74AC373 OCTAL D-TYPE TRANSPARENT LATCHES WITH 3-STATE OUTPUTS

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recommended operating conditions (see Note 3)

| | | SN54AC373 | | SN74AC373 | | UNIT |
|-----------------|------------------------------------|-------------------------|-----------------|-----------|-----------------|------|
| | | MIN | MAX | MIN | MAX | |
| V _{CC} | Supply voltage | 2 | 6 | 2 | 6 | V |
| V _{IH} | High-level input voltage | V _{CC} = 3 V | | 2.1 | | V |
| | | V _{CC} = 4.5 V | | 3.15 | | |
| | | V _{CC} = 5.5 V | | 3.85 | | |
| V _{IL} | Low-level input voltage | V _{CC} = 3 V | | 0.9 | | V |
| | | V _{CC} = 4.5 V | | 1.35 | | |
| | | V _{CC} = 5.5 V | | 1.65 | | |
| V _I | Input voltage | 0 | V _{CC} | 0 | V _{CC} | V |
| V _O | Output voltage | 0 | V _{CC} | 0 | V _{CC} | V |
| I _{OH} | High-level output current | V _{CC} = 3 V | | -12 | | mA |
| | | V _{CC} = 4.5 V | | -24 | | |
| | | V _{CC} = 5.5 V | | -24 | | |
| I _{OL} | Low-level output current | V _{CC} = 3 V | | 12 | | mA |
| | | V _{CC} = 4.5 V | | 24 | | |
| | | V _{CC} = 5.5 V | | 24 | | |
| Δt/Δv | Input transition rise or fall rate | 8 | | 8 | | ns/V |
| T _A | Operating free-air temperature | -55 | 125 | -40 | 85 | °C |

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

| PARAMETER | TEST CONDITIONS | V _{CC} | T _A = 25°C | | | SN54AC373 | | SN74AC373 | | UNIT |
|-----------------|---|-----------------|-----------------------|-----|-----|-----------|-----|-----------|-----|------|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| V _{OH} | I _{OH} = -50 μA | 3 V | 2.9 | | | 2.9 | | 2.9 | | V |
| | | 4.5 V | 4.4 | | | 4.4 | | 4.4 | | |
| | | 5.5 V | 5.4 | | | 5.4 | | 5.4 | | |
| | I _{OH} = -12 mA | 3 V | 2.56 | | | 2.4 | | 2.46 | | |
| | | 4.5 V | 3.86 | | | 3.7 | | 3.76 | | |
| | | 5.5 V | 4.86 | | | 4.7 | | 4.76 | | |
| V _{OL} | I _{OL} = 50 μA | 3 V | 0.1 | | | 0.1 | | 0.1 | | V |
| | | 4.5 V | 0.1 | | | 0.1 | | 0.1 | | |
| | | 5.5 V | 0.1 | | | 0.1 | | 0.1 | | |
| | I _{OL} = 12 mA | 3 V | 0.36 | | | 0.5 | | 0.44 | | |
| | | 4.5 V | 0.36 | | | 0.5 | | 0.44 | | |
| | | 5.5 V | 0.36 | | | 0.5 | | 0.44 | | |
| I _I | V _I = V _{CC} or GND | 5.5 V | ±0.1 | | | ±1 | | ±1 | | μA |
| I _{OZ} | V _O = V _{CC} or GND | 5.5 V | ±0.25 | | | ±5 | | ±2.5 | | μA |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 5.5 V | 4 | | | 80 | | 40 | | μA |
| C _i | V _I = V _{CC} or GND | 5 V | 4.5 | | | | | | | pF |

SN54AC373, SN74AC373 OCTAL D-TYPE TRANSPARENT LATCHES WITH 3-STATE OUTPUTS

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timing requirements over recommended operating free-air temperature range, $V_{CC} = 3.3 V \pm 0.3 V$ (unless otherwise noted) (see Figure 1)

| | | $T_A = 25^\circ C$ | | SN54AC373 | | SN74AC373 | | UNIT |
|----------|-----------------------------|--------------------|-----|-----------|-----|-----------|-----|------|
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| t_w | Pulse duration, LE high | 5.5 | | 6.5 | | 6 | | ns |
| t_{su} | Setup time, data before LE↓ | 5.5 | | 6.5 | | 6 | | ns |
| t_h | Hold time, data after LE↓ | 1 | | 1 | | 1 | | ns |

timing requirements over recommended operating free-air temperature range, $V_{CC} = 5 V \pm 0.5 V$ (unless otherwise noted) (see Figure 1)

| | | $T_A = 25^\circ C$ | | SN54AC373 | | SN74AC373 | | UNIT |
|----------|-----------------------------|--------------------|-----|-----------|-----|-----------|-----|------|
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| t_w | Pulse duration, LE high | 4 | | 5 | | 4.5 | | ns |
| t_{su} | Setup time, data before LE↓ | 4 | | 5 | | 4.5 | | ns |
| t_h | Hold time, data after LE↓ | 1 | | 1 | | 1 | | ns |

switching characteristics over recommended operating free-air temperature range, $V_{CC} = 3.3 V \pm 0.3 V$ (unless otherwise noted) (see Figure 1)

| PARAMETER | TO (INPUT) | TO (OUTPUT) | $T_A = 25^\circ C$ | | | SN54AC373 | | SN74AC373 | | UNIT |
|-----------|-----------------|-------------|--------------------|-----|------|-----------|------|-----------|------|------|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| t_{PLH} | D | Q | 1.5 | 10 | 13.5 | 1 | 16.5 | 1.5 | 15 | ns |
| t_{PHL} | | | 1.5 | 9.5 | 13.0 | 1 | 16 | 1.5 | 14.5 | |
| t_{PLH} | LE | Q | 1.5 | 10 | 13.5 | 1 | 16.5 | 1.5 | 15 | ns |
| t_{PHL} | | | 1.5 | 9.5 | 12.5 | 1 | 15 | 1.5 | 14 | |
| t_{PZH} | \overline{OE} | Q | 1.5 | 9 | 11.5 | 1 | 14 | 1 | 13 | ns |
| t_{PZL} | | | 1.5 | 8.5 | 11.5 | 1 | 13.5 | 1 | 13 | |
| t_{PHZ} | \overline{OE} | Q | 1.5 | 10 | 12.5 | 1 | 16 | 1 | 14.5 | ns |
| t_{PLZ} | | | 1.5 | 8 | 11.5 | 1 | 13 | 1 | 12.5 | |

switching characteristics over recommended operating free-air temperature range, $V_{CC} = 5 V \pm 0.5 V$ (unless otherwise noted) (see Figure 1)

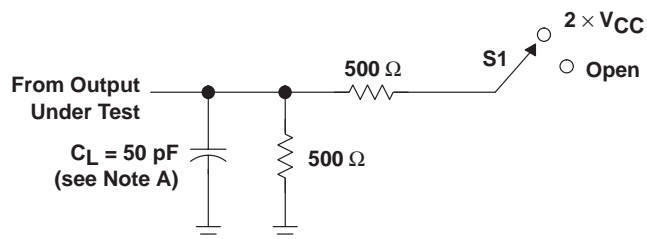
| PARAMETER | TO (INPUT) | TO (OUTPUT) | $T_A = 25^\circ C$ | | | SN54AC373 | | SN74AC373 | | UNIT |
|-----------|-----------------|-------------|--------------------|-----|-----|-----------|------|-----------|------|------|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| t_{PLH} | D | Q | 1.5 | 7 | 9.5 | 1 | 11.5 | 1.5 | 10.5 | ns |
| t_{PHL} | | | 1.5 | 7 | 9.5 | 1 | 11.5 | 1.5 | 10.5 | |
| t_{PLH} | LE | Q | 1.5 | 7.5 | 9.5 | 1 | 12 | 1.5 | 10.5 | ns |
| t_{PHL} | | | 1.5 | 7 | 9.5 | 1 | 11 | 1.5 | 10.5 | |
| t_{PZH} | \overline{OE} | Q | 1.5 | 7 | 8.5 | 1 | 10.5 | 1 | 9.5 | ns |
| t_{PZL} | | | 1.5 | 6.5 | 8.5 | 1 | 10 | 1 | 9.5 | |
| t_{PHZ} | \overline{OE} | Q | 1.5 | 8 | 11 | 1 | 13.5 | 1 | 12.5 | ns |
| t_{PLZ} | | | 1.5 | 6.5 | 8.5 | 1 | 10.5 | 1 | 10 | |

operating characteristics, $V_{CC} = 5 V, T_A = 25^\circ C$

| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|--|--------------------------|-----|------|
| C_{pd} Power dissipation capacitance | $C_L = 50 pF, f = 1 MHz$ | 40 | pF |

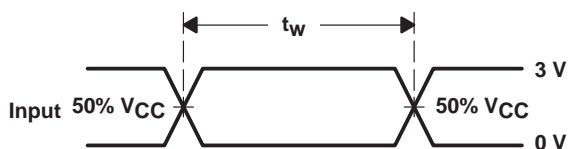


PARAMETER MEASUREMENT INFORMATION

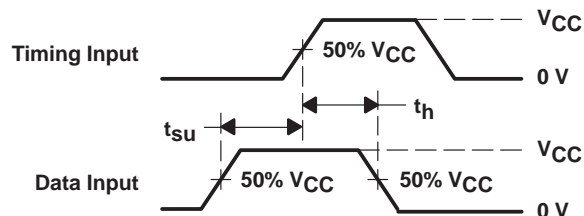


LOAD CIRCUIT

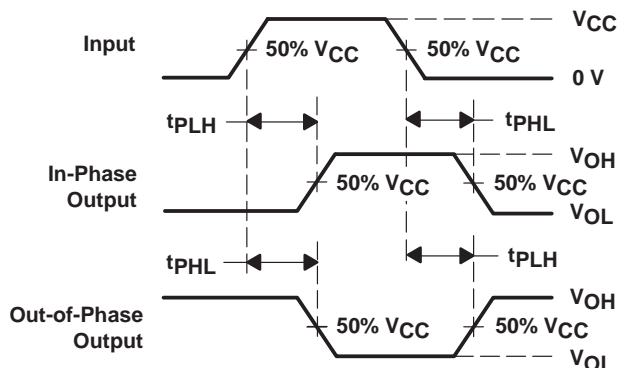
| TEST | S1 |
|-------------------|-------------------|
| t_{PLH}/t_{PHL} | Open |
| t_{PLZ}/t_{PZL} | 2 $\times V_{CC}$ |
| t_{PHZ}/t_{PZH} | Open |



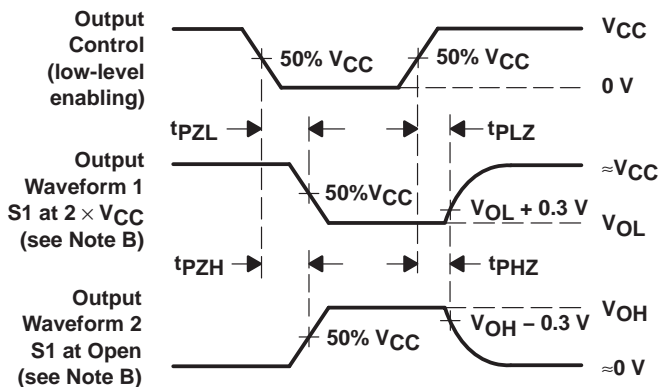
VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS

- NOTES: A. C_L includes probe and jig capacitance.
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
 C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
 D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-87555012A | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| 5962-8755501RA | ACTIVE | CDIP | J | 20 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| 5962-8755501SA | ACTIVE | CFP | W | 20 | 1 | TBD | A42 | N / A for Pkg Type |
| 5962-8755501VRA | ACTIVE | CDIP | J | 20 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| 5962-8755501VSA | ACTIVE | CFP | W | 20 | 1 | TBD | A42 | N / A for Pkg Type |
| SN74AC373DBLE | OBSOLETE | SSOP | DB | 20 | | TBD | Call TI | Call TI |
| SN74AC373DBR | ACTIVE | SSOP | DB | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AC373DBRE4 | ACTIVE | SSOP | DB | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AC373DW | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AC373DWE4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AC373DWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AC373DWRE4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AC373N | ACTIVE | PDIP | N | 20 | 20 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN74AC373NE4 | ACTIVE | PDIP | N | 20 | 20 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN74AC373NSR | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AC373NSRE4 | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AC373PW | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AC373PWE4 | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AC373PWLE | OBSOLETE | TSSOP | PW | 20 | | TBD | Call TI | Call TI |
| SN74AC373PWR | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AC373PWRE4 | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SNJ54AC373FK | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| SNJ54AC373J | ACTIVE | CDIP | J | 20 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| SNJ54AC373W | ACTIVE | CFP | W | 20 | 1 | TBD | A42 | N / A for Pkg Type |

⁽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⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---------------|------------------------|------------------------|------------------------|------------------------|
| A | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC |
| B MAX | 0.785 (19,94) | .840 (21,34) | 0.960 (24,38) | 1.060 (26,92) |
| B MIN | — | — | — | — |
| C MAX | 0.300 (7,62) | 0.300 (7,62) | 0.310 (7,87) | 0.300 (7,62) |
| C MIN | 0.245 (6,22) | 0.245 (6,22) | 0.220 (5,59) | 0.245 (6,22) |



4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package is hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F20)

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 GDFP2-F20

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



4040140/D 10/96

- 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 metal lid.
 - D. The terminals are gold plated.
 - E. Falls within JEDEC MS-004

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.

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-013 variation AC.

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.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 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.
 D. Falls within JEDEC MO-150

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- 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.
 D. Falls within JEDEC MO-153

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