

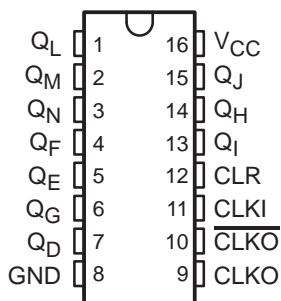
SN54HC4060, SN74HC4060

14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

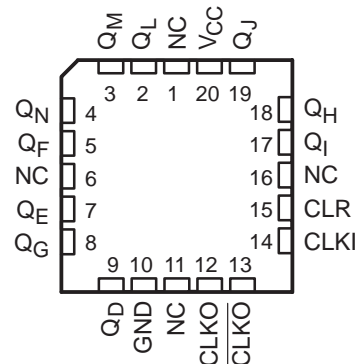
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- Wide Operating Voltage Range of 2 V to 6 V
- Outputs Can Drive Up To 10 LSTTL Loads
- Low Power Consumption, 80- μ A Max I_{CC}
- Typical $t_{pd} = 14$ ns
- ± 4 -mA Output Drive at 5 V
- Low Input Current of 1 μ A Max
- Allow Design of Either RC- or Crystal-Oscillator Circuits

SN54HC4060 . . . J OR W PACKAGE
SN74HC4060 . . . D, DB, N, NS, OR PW PACKAGE
(TOP VIEW)



SN54HC4060 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

The 'HC4060 devices consist of an oscillator section and 14 ripple-carry binary counter stages. The oscillator configuration allows design of either RC- or crystal-oscillator circuits. A high-to-low transition on the clock (CLKI) input increments the counter. A high level at the clear (CLR) input disables the oscillator ($\overline{\text{CLKO}}$ goes high and CLKO goes low) and resets the counter to zero (all Q outputs low).

ORDERING INFORMATION

| TA | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------|--------------|-----------------------|------------------|
| –40°C to 85°C | PDIP – N | Tube of 25 | SN74HC4060N | SN74HC4060N |
| | SOIC – D | Tube of 40 | SN74HC4060D | HC4060 |
| | | Reel of 2500 | SN74HC4060DR | |
| | | Reel of 250 | SN74HC4060DT | |
| | SOP – NS | Reel of 2000 | SN74HC4060NSR | HC4060 |
| | SSOP – DB | Reel of 2000 | SN74HC4060DBR | HC4060 |
| –55°C to 125°C | TSSOP – PW | Tube of 90 | SN74HC4060PW | HC4060 |
| | | Reel of 2000 | SN74HC4060PWR | |
| | | Reel of 250 | SN74HC4060PWT | |
| | CDIP – J | Tube of 25 | SNJ54HC4060J | SNJ54HC4060J |
| | CFP – W | Tube of 150 | SNJ54HC4060W | SNJ54HC4060W |
| | LCCC – FK | Tube of 55 | SNJ54HC4060FK | SNJ54HC4060FK |

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



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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.

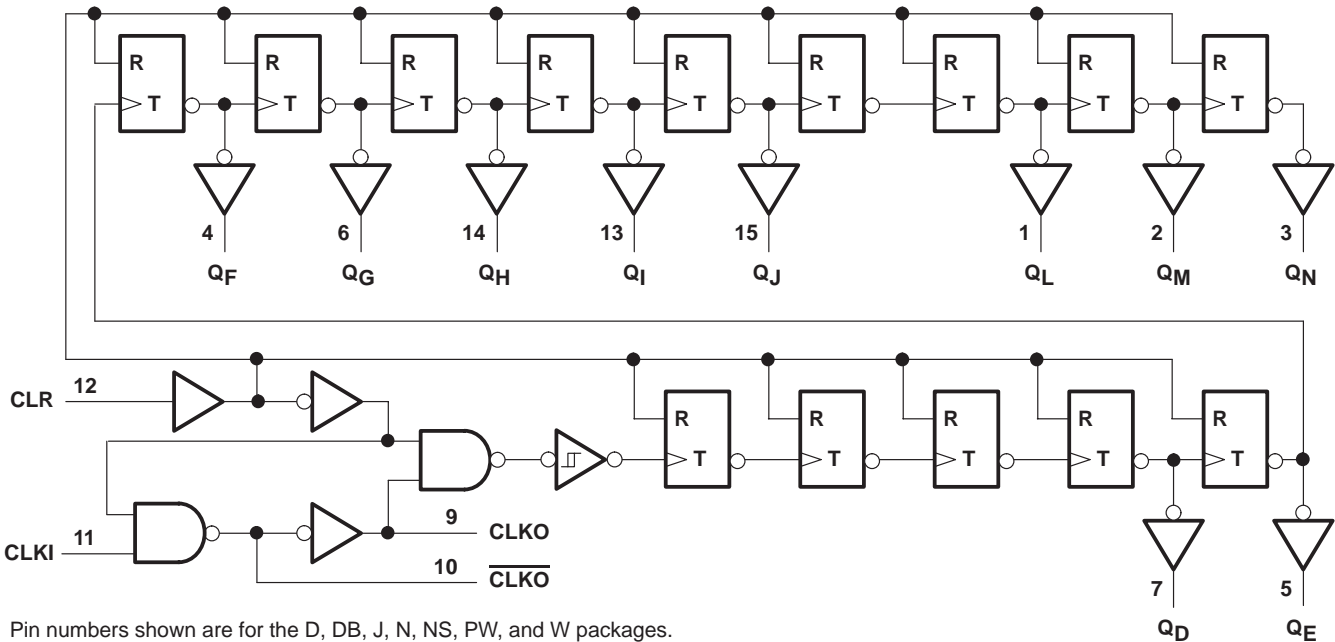
SN54HC4060, SN74HC4060
14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

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FUNCTION TABLE
(each buffer)

Table with 3 columns: INPUTS (CLK, CLR), FUNCTION. Rows: (up arrow, L) No change; (down arrow, L) Advance to next stage; (X, H) All outputs L.

logic diagram (positive logic)



Pin numbers shown are for the D, DB, J, N, NS, PW, and W packages.

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

Table with 2 columns: Parameter and Rating. Parameters include Supply voltage range, Input clamp current, Output clamp current, Continuous output current, Package thermal impedance (for D, DB, N, NS, PW packages), and Storage temperature range.

† 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.

SN54HC4060, SN74HC4060

14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

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recommended operating conditions (see Note 3)

| | | | SN54HC4060 | | | SN74HC4060 | | | UNIT |
|---------------------|---------------------------------|-------------------------|------------|-----|-----------------|------------|-----|-----------------|------|
| | | | MIN | NOM | MAX | MIN | NOM | MAX | |
| V _{CC} | Supply voltage | | 2 | 5 | 6 | 2 | 5 | 6 | V |
| V _{IH} | High-level input voltage | V _{CC} = 2 V | 1.5 | | | 1.5 | | | V |
| | | V _{CC} = 4.5 V | 3.15 | | | 3.15 | | | |
| | | V _{CC} = 6 V | 4.2 | | | 4.2 | | | |
| V _{IL} | Low-level input voltage | V _{CC} = 2 V | | | 0.5 | | | 0.5 | V |
| | | V _{CC} = 4.5 V | | | 1.35 | | | 1.35 | |
| | | V _{CC} = 6 V | | | 1.8 | | | 1.8 | |
| V _I | Input voltage | | 0 | | V _{CC} | 0 | | V _{CC} | V |
| V _O | Output voltage | | 0 | | V _{CC} | 0 | | V _{CC} | V |
| $\Delta t/\Delta v$ | Input transition rise/fall time | V _{CC} = 2 V | | | 1000 | | | 1000 | ns |
| | | V _{CC} = 4.5 V | | | 500 | | | 500 | |
| | | V _{CC} = 6 V | | | 400 | | | 400 | |
| 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 | | | SN54HC4060 | | SN74HC4060 | | UNIT |
|-----------------|-------------|---|--|-----------------|-----------------------|-------|------|------------|-------|------------|-------|------|
| | | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| V _{OH} | All outputs | V _I = V _{IH} or V _{IL} , I _{OH} = –20 µA | | 2 V | 1.9 | 1.998 | | 1.9 | | 1.9 | | V |
| | | | | 4.5 V | 4.4 | 4.499 | | 4.4 | | 4.4 | | |
| | | | | 6 V | 5.9 | 5.999 | | 5.9 | | 5.9 | | |
| | Q outputs | V _I = V _{IH} or V _{IL} , I _{OH} = –4 mA I _{OH} = –5.2 mA | | 4.5 V | 3.98 | 4.3 | | 3.7 | | 3.84 | | |
| | | | | 6 V | 5.48 | 5.8 | | 5.2 | | 5.34 | | |
| V _{OL} | All outputs | V _I = V _{IH} or V _{IL} , I _{OL} = 20 µA | | 2 V | | 0.002 | 0.1 | | 0.1 | | 0.1 | V |
| | | | | 4.5 V | | 0.001 | 0.1 | | 0.1 | | 0.1 | |
| | | | | 6 V | | 0.001 | 0.1 | | 0.1 | | 0.1 | |
| | Q outputs | V _I = V _{IH} or V _{IL} , I _{OL} = 4 mA I _{OL} = 5.2 mA | | 4.5 V | | 0.17 | 0.26 | | 0.4 | | 0.33 | |
| | | | | 6 V | | 0.15 | 0.26 | | 0.4 | | 0.33 | |
| I _I | | V _I = V _{CC} or 0 | | 6 V | | ±0.1 | ±100 | | ±1000 | | ±1000 | nA |
| I _{CC} | | V _I = V _{CC} or 0, I _O = 0 | | 6 V | | | 8 | | 160 | | 80 | µA |
| C _i | | | | 2 V to 6 V | | 3 | 10 | | 10 | | 10 | pF |



SN54HC4060, SN74HC4060

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timing requirements over recommended operating free-air temperature range (unless otherwise noted)

| | | | V _{CC} | T _A = 25°C | | SN54HC4060 | | SN74HC4060 | | UNIT |
|--------------------|---------------------------------------|------------------|-----------------|-----------------------|-----|------------|-----|------------|-----|------|
| | | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| f _{clock} | Clock frequency | | 2 V | 5.5 | | 3.7 | | 4.3 | | MHz |
| | | | 4.5 V | 28 | | 19 | | 22 | | |
| | | | 6 V | 33 | | 22 | | 25 | | |
| t _w | Pulse duration | CLKI high or low | 2 V | 90 | 135 | | 115 | | ns | |
| | | | 4.5 V | 18 | 27 | | 23 | | | |
| | | | 6 V | 15 | 23 | | 20 | | | |
| | CLR high | 2 V | 90 | 135 | | 115 | | | | |
| | | 4.5 V | 18 | 27 | | 23 | | | | |
| | | 6 V | 15 | 23 | | 20 | | | | |
| t _{su} | Setup time, CLR inactive before CLKI↓ | | 2 V | 160 | 240 | | 200 | | ns | |
| | | | 4.5 V | 32 | 48 | | 40 | | | |
| | | | 6 V | 27 | 41 | | 34 | | | |

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} | T _A = 25°C | | | SN54HC4060 | | SN74HC4060 | | UNIT |
|------------------|--------------|----------------|-----------------|-----------------------|-----|-----|------------|-----|------------|-----|------|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| f _{max} | | | 2 V | 5.5 | 10 | | 3.7 | | 4.3 | | MHz |
| | | | 4.5 V | 28 | 45 | | 19 | | 22 | | |
| | | | 6 V | 33 | 53 | | 22 | | 25 | | |
| t _{pd} | CLKI | Q _D | 2 V | | 240 | 490 | | 735 | | 615 | ns |
| | | | 4.5 V | | 58 | 98 | | 147 | | 123 | |
| | | | 6 V | | 42 | 83 | | 125 | | 105 | |
| t _{PHL} | CLR | Any Q | 2 V | | 66 | 140 | | 210 | | 175 | ns |
| | | | 4.5 V | | 18 | 28 | | 42 | | 35 | |
| | | | 6 V | | 14 | 24 | | 36 | | 30 | |
| t _t | | Any | 2 V | | 28 | 75 | | 110 | | 95 | ns |
| | | | 4.5 V | | 8 | 15 | | 22 | | 19 | |
| | | | 6 V | | 6 | 30 | | 19 | | 16 | |

operating characteristics, T_A = 25°C

| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|---|-----------------|-----|------|
| C _{pd} Power dissipation capacitance | No load | 88 | pF |



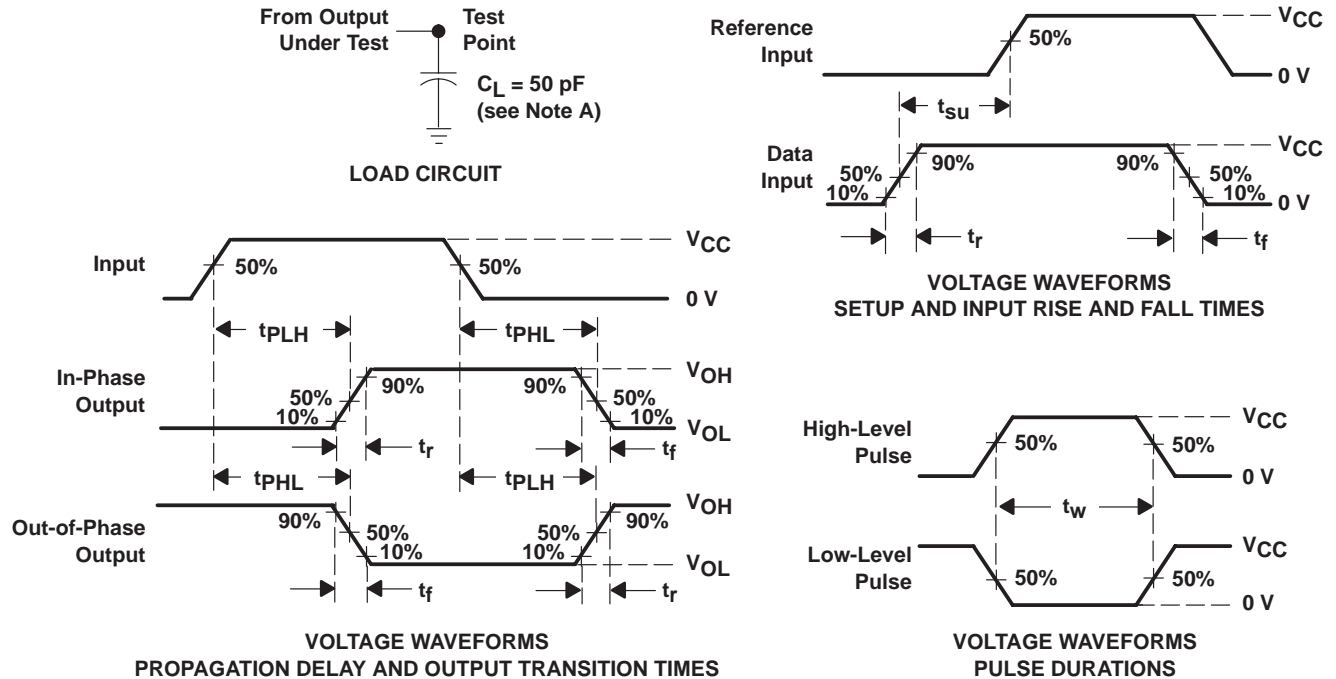
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SN54HC4060, SN74HC4060

14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

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PARAMETER MEASUREMENT INFORMATION



- NOTES:
- A. C_L includes probe and test-fixture capacitance.
 - B. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 6 \text{ ns}$, $t_f = 6 \text{ ns}$.
 - C. For clock inputs, f_{max} is measured when the input duty cycle is 50%.
 - D. The outputs are measured one at a time with one input transition per measurement.
 - E. t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

SN54HC4060, SN74HC4060

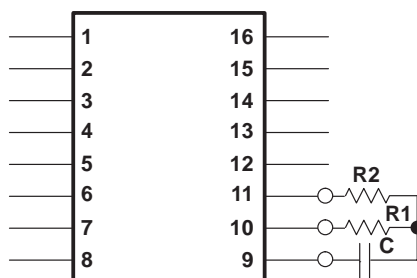
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CONNECTING AN RC-OSCILLATOR CIRCUIT TO THE 'HC4060 DEVICES

The 'HC4060 devices consist of an oscillator section and 14 ripple-carry binary counter stages. The oscillator configuration allows design of either RC- or crystal-oscillator circuits.

When an RC-oscillator circuit is implemented, two resistors and a capacitor are required. The components are attached to the terminals as shown:



To determine the values of capacitance and resistance necessary to obtain a specific oscillator frequency (f), use this formula:

$$f = \frac{1}{2(R1)(C)\left(\frac{0.405 R2}{R1 + R2} + 0.693\right)}$$

If $R2 \gg R1$ (i.e., $R2 = 10R1$), the above formula simplifies to:

$$f = \frac{0.455}{RC}$$

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|--|
| SN54HC4060FK | ACTIVE | LCCC | FK | 20 | 1 | TBD | Call TI | Level-NC-NC-NC |
| SN74HC4060D | ACTIVE | SOIC | D | 16 | 40 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN74HC4060DBR | ACTIVE | SSOP | DB | 16 | 2000 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN74HC4060DR | ACTIVE | SOIC | D | 16 | 2500 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN74HC4060DT | ACTIVE | SOIC | D | 16 | 250 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN74HC4060N | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPDAU | Level-NC-NC-NC |
| SN74HC4060NSR | ACTIVE | SO | NS | 16 | 2000 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN74HC4060PW | ACTIVE | TSSOP | PW | 16 | 90 | Pb-Free (RoHS) | CU NIPDAU | Level-1-250C-UNLIM |
| SN74HC4060PWE4 | ACTIVE | TSSOP | PW | 16 | 90 | Pb-Free (RoHS) | CU NIPDAU | Level-1-250C-UNLIM |
| SN74HC4060PWR | ACTIVE | TSSOP | PW | 16 | 2000 | Pb-Free (RoHS) | CU NIPDAU | Level-1-250C-UNLIM |
| SN74HC4060PWRE4 | ACTIVE | TSSOP | PW | 16 | 2000 | Pb-Free (RoHS) | CU NIPDAU | Level-1-250C-UNLIM |
| SN74HC4060PWT | ACTIVE | TSSOP | PW | 16 | 250 | Pb-Free (RoHS) | CU NIPDAU | Level-1-250C-UNLIM |
| SN74HC4060PWTE4 | ACTIVE | TSSOP | PW | 16 | 250 | Pb-Free (RoHS) | CU NIPDAU | Level-1-250C-UNLIM |

⁽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) 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.

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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FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - The terminals are gold plated.
 - Falls within JEDEC MS-004

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.

D (R-PDSO-G16)

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-012 variation AC.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



| DIM \ PINS ** | 14 | 16 | 20 | 24 |
|---------------|-------|-------|-------|-------|
| A MAX | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN | 9,90 | 9,90 | 12,30 | 14,70 |

4040062/C 03/03

- 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



- 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

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN54HC4060FK | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| SN74HC4060D | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060DBR | ACTIVE | SSOP | DB | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060DBRE4 | ACTIVE | SSOP | DB | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060DE4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060DR | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060DRE4 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060DT | ACTIVE | SOIC | D | 16 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060DTE4 | ACTIVE | SOIC | D | 16 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060N | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN74HC4060NE4 | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN74HC4060NSR | ACTIVE | SO | NS | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060NSRE4 | ACTIVE | SO | NS | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060PW | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060PWE4 | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060PWG4 | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060PWR | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060PWRE4 | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060PWG4 | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060PWT | ACTIVE | TSSOP | PW | 16 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74HC4060PWTE4 | ACTIVE | TSSOP | PW | 16 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

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⁽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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FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - The terminals are gold plated.
 - Falls within JEDEC MS-004

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 |



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.

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



4040047-4/H 11/2006

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 .006 (0,15) per end.
- D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
- E. Reference JEDEC MS-012 variation AC.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



| DIM \ PINS ** | 14 | 16 | 20 | 24 |
|---------------|-------|-------|-------|-------|
| A MAX | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN | 9,90 | 9,90 | 12,30 | 14,70 |

4040062/C 03/03

- 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



- 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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