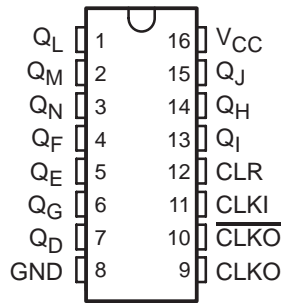


SN54HC4060, SN74HC4060 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

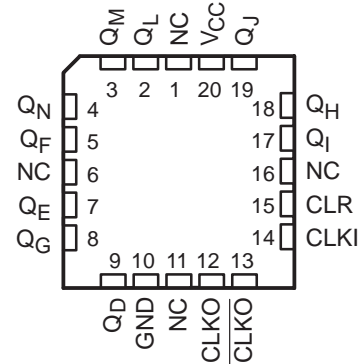
SCLS161D – DECEMBER 1982 – REVISED SEPTEMBER 2003

- 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 ($CLKO$ 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	
-55°C to 125°C	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.

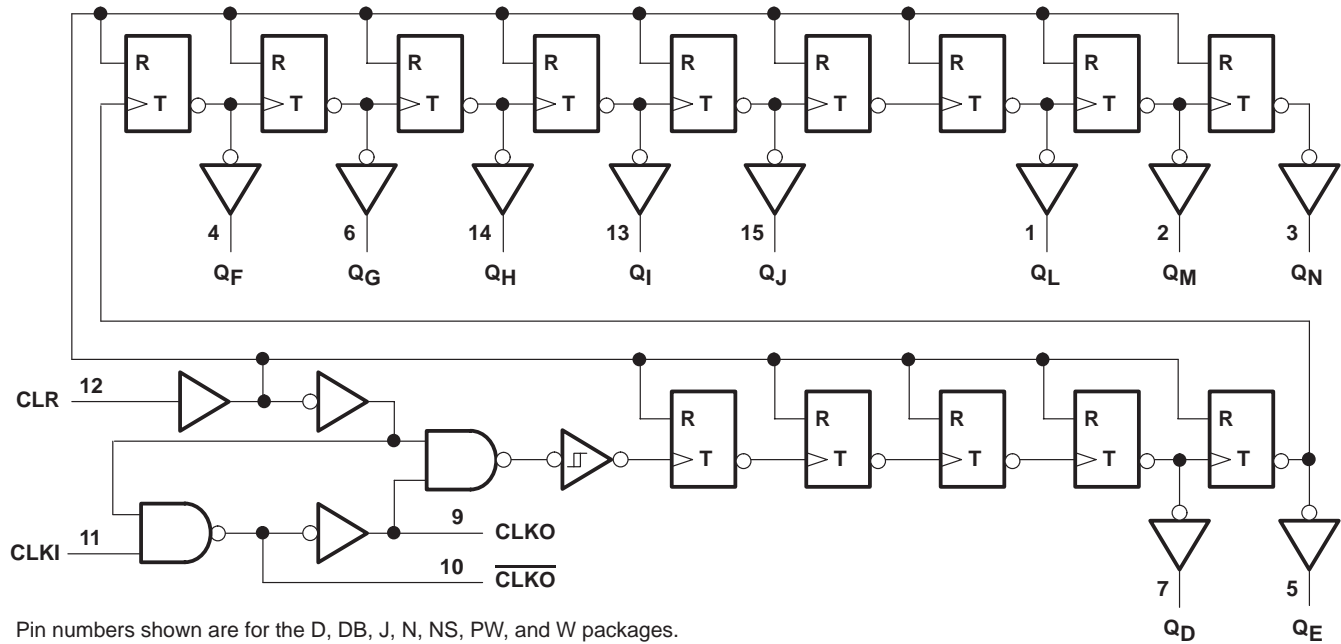
SN54HC4060, SN74HC4060 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

SCLS161D – DECEMBER 1982 – REVISED SEPTEMBER 2003

FUNCTION TABLE
(each buffer)

INPUTS		FUNCTION
CLK	CLR	
↑	L	No change
↓	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)†

Supply voltage range, V_{CC}	-0.5 V to 7 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) (see Note 1)	±20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) (see Note 1)	±20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	±25 mA
Package thermal impedance, θ_{JA} (see Note 2):	
D package	73°C/W
DB package	82°C/W
N package	67°C/W
NS package	64°C/W
PW package	108°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.

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
Δt/Δv	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	4.5 V	3.98	4.3		3.7			3.84
I _{OH} = -5.2 mA				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	4.5 V		0.17	0.26		0.4		
I _{OL} = 5.2 mA				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 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

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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

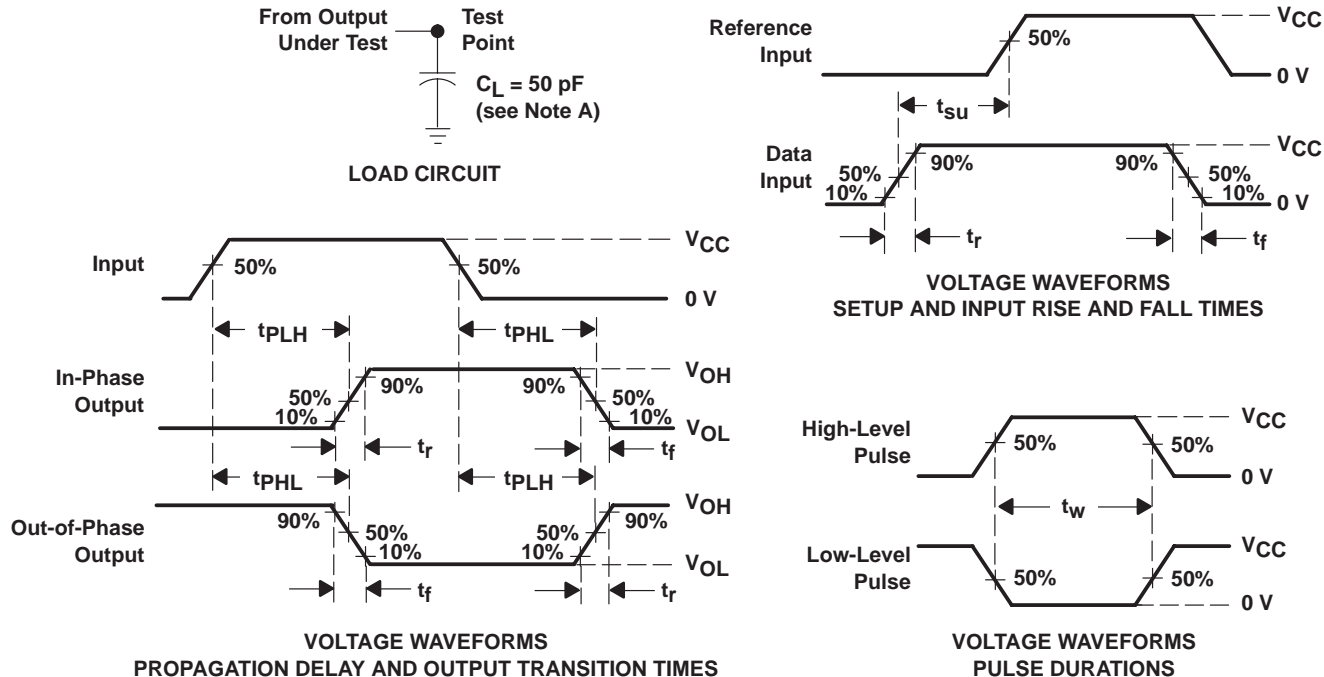
PARAMETER	TEST CONDITIONS	TYP	UNIT
C _{pd} Power dissipation capacitance	No load	88	pF



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: $PRR \leq 1$ MHz, $Z_O = 50 \Omega$, $t_r = 6$ ns, $t_f = 6$ 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

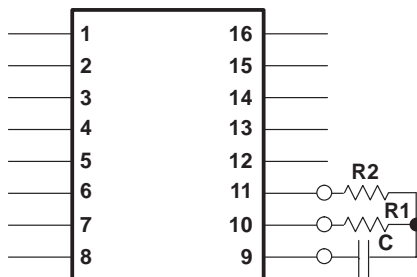
SN54HC4060, SN74HC4060 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

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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 finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN54HC4060FK	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SN54HC4060FK	Samples
SN74HC4060DBR	ACTIVE	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC4060	Samples
SN74HC4060DR	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC4060	Samples
SN74HC4060N	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-40 to 85	SN74HC4060N	Samples
SN74HC4060NSR	ACTIVE	SO	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC4060	Samples
SN74HC4060NSRE4	ACTIVE	SO	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC4060	Samples
SN74HC4060PWR	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	HC4060	Samples
SN74HC4060PWRG4	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC4060	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.

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 <=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 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 SN54HC4060, SN74HC4060 :

- Catalog : [SN74HC4060](#)
- Automotive : [SN74HC4060-Q1](#), [SN74HC4060-Q1](#)
- Military : [SN54HC4060](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- 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
SN74HC4060DBR	SSOP	DB	16	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN74HC4060DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74HC4060NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74HC4060PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74HC4060PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74HC4060PWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74HC4060DBR	SSOP	DB	16	2000	356.0	356.0	35.0
SN74HC4060DR	SOIC	D	16	2500	340.5	336.1	32.0
SN74HC4060NSR	SO	NS	16	2000	356.0	356.0	35.0
SN74HC4060PWR	TSSOP	PW	16	2000	356.0	356.0	35.0
SN74HC4060PWR	TSSOP	PW	16	2000	364.0	364.0	27.0
SN74HC4060PWRG4	TSSOP	PW	16	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)
SN54HC4060FK	FK	LCCC	20	55	506.98	12.06	2030	NA
SN74HC4060N	N	PDIP	16	25	506	13.97	11230	4.32
SN74HC4060N	N	PDIP	16	25	506	13.97	11230	4.32

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\

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.



PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

SOP



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 0.25 mm, per side.

EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER MASK DETAILS

4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

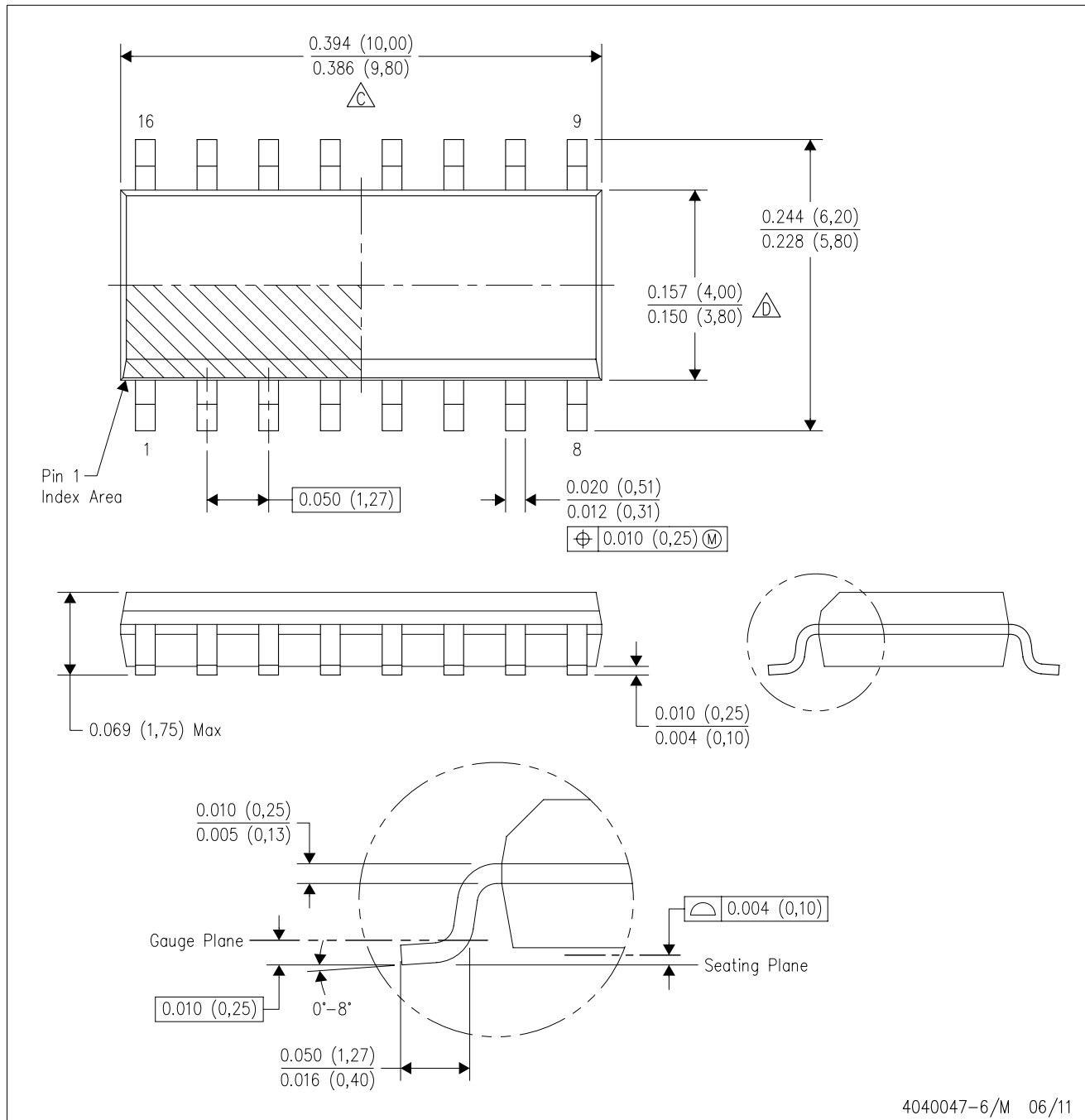
4220735/A 12/2021

NOTES: (continued)



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

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

- 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 AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. 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.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



4220204/A 02/2017

NOTES:

1. All linear dimensions are in millimeters. Any 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 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220204/A 02/2017

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

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220204/A 02/2017

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.

DB0016A



PACKAGE OUTLINE

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



4220763/A 05/2022

NOTES:

1. All linear dimensions are in millimeters. Any 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. Reference JEDEC registration MO-150.

EXAMPLE BOARD LAYOUT

DB0016A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220763/A 05/2022

NOTES: (continued)

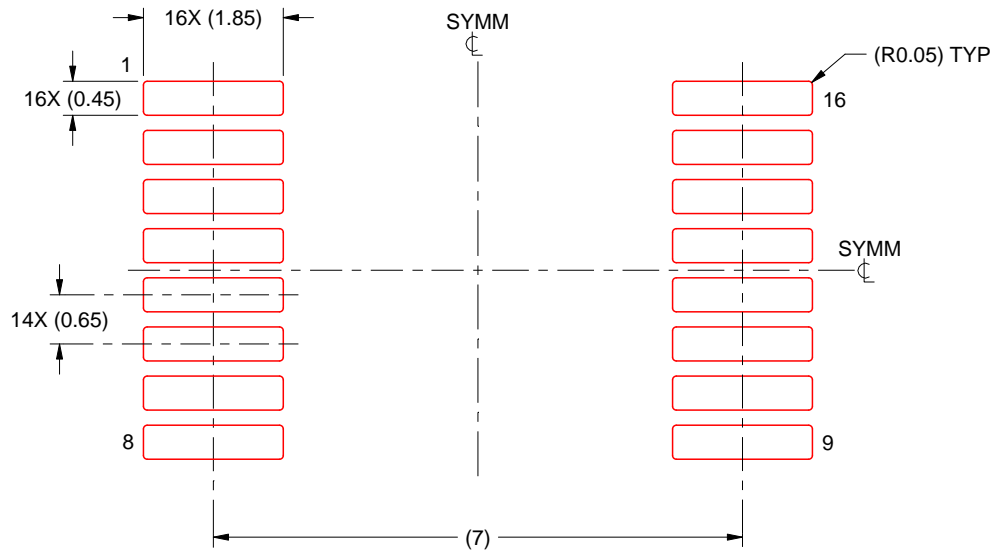
- 5. Publication IPC-7351 may have alternate designs.
- 6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DB0016A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220763/A 05/2022

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. 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.

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