

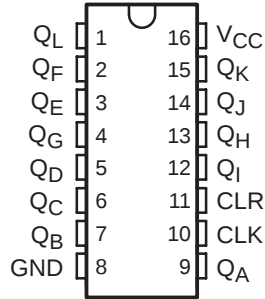
SN54HC4040, SN74HC4040

12-BIT ASYNCHRONOUS BINARY COUNTERS

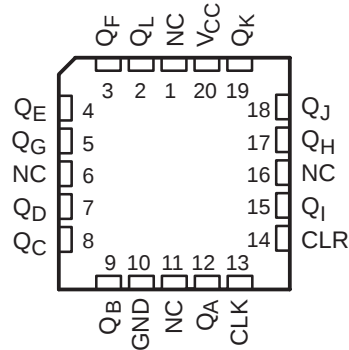
SCLS160D – DECEMBER 1982 – REVISED SEPTEMBER 2003

- 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 $t_{pd} = 12$ ns
- ± 4 -mA Output Drive at 5 V
- Low Input Current of 1 μ A Max

SN54HC4040 . . . J OR W PACKAGE
SN74HC4040 . . . D, DB, N, NS, OR PW PACKAGE
(TOP VIEW)



SN54HC4040 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

The 'HC4040 devices are 12-stage asynchronous binary counters, with the outputs of all stages available externally. A high level at the clear (CLR) input asynchronously clears the counter and resets all outputs low. The count is advanced on a high-to-low transition at the clock (CLK) input. Applications include time-delay circuits, counter controls, and frequency-dividing circuits.

ORDERING INFORMATION

T _A	PACKAGE [†]	PACKAGE [†]	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	PDIP – N	Tube of 25	SN74HC4040N	SN74HC4040N
	SOIC – D	Tube of 40	SN74HC4040D	HC4040
		Reel of 2500	SN74HC4040DR	
		Reel of 250	SN74HC4040DT	
	SOP – NS	Reel of 2000	SN74HC4040NSR	HC4040
	SSOP – DB	Reel of 2000	SN74HC4040DBR	HC4040
	TSSOP – PW	Tube of 90	SN74HC4040PW	HC4040
		Reel of 2000	SN74HC4040PWR	
Reel of 250		SN74HC4040PWT		
–55°C to 125°C	CDIP – J	Tube of 25	SNJ54HC4040J	SNJ54HC4040J
	CFP – W	Tube of 150	SNJ54HC4040W	SNJ54HC4040W
	LCCC – FK	Tube of 55	SNJ54HC4040FK	SNJ54HC4040FK

[†] 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.

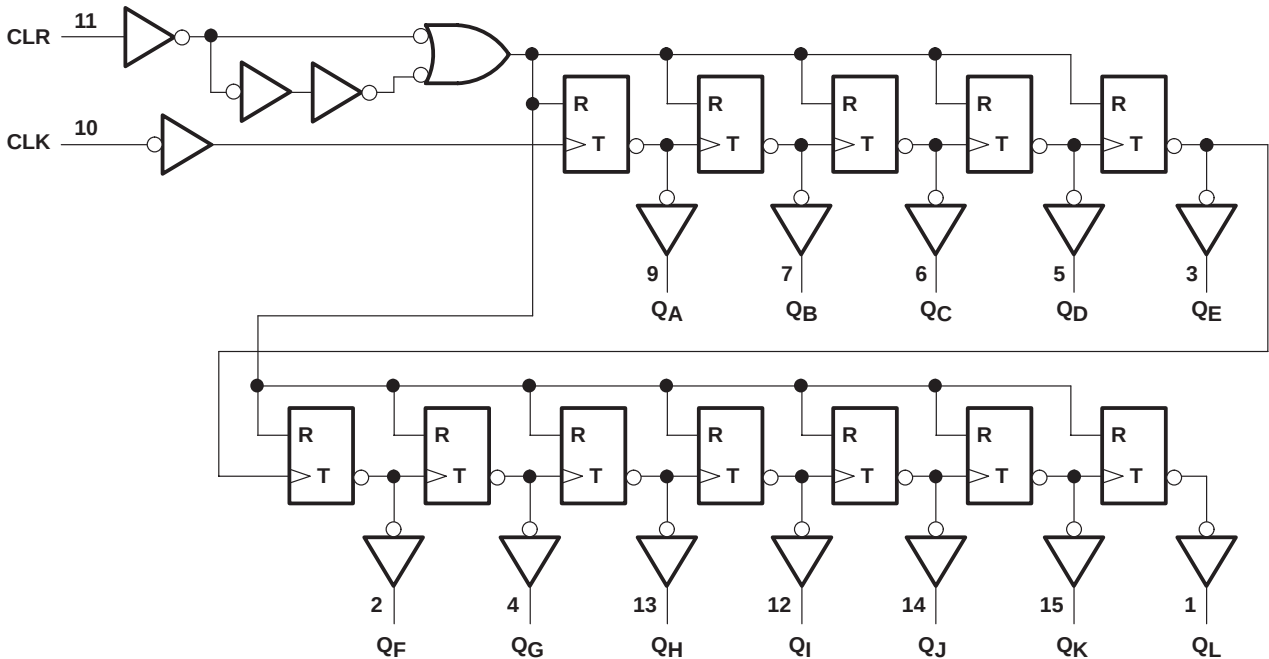
SN54HC4040, SN74HC4040
12-BIT ASYNCHRONOUS BINARY COUNTERS

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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
Continuous current through V_{CC} or GND	±50 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.



SN54HC4040, SN74HC4040

12-BIT ASYNCHRONOUS BINARY COUNTERS

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recommended operating conditions (see Note 3)

			SN54HC4040			SN74HC4040			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
$\Delta t/\Delta v^\dagger$	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

[†] If this device is used in the threshold region (from V_{ILmax} = 0.5 V to V_{IHmin} = 1.5 V), there is a potential to go into the wrong state from induced grounding, causing double clocking. Operating with the inputs at t_i = 1000 ns and V_{CC} = 2 V does not damage the device; however, functionally, the CLK inputs are not ensured while in the shift, count, or toggle operating modes.

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			SN54HC4040		SN74HC4040		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	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		
		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}	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	
		I _{OL} = 4 mA	4.5 V		0.17	0.26		0.4		0.33	
		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



SN54HC4040, SN74HC4040

12-BIT ASYNCHRONOUS BINARY COUNTERS

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

			V _{CC}	T _A = 25°C		SN54HC4040		SN74HC4040		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	CLK high or low	2 V	90		135		115		ns
			4.5 V	18		27		23		
			6 V	15		23		20		
	CLR high	2 V	70		105		90			
		4.5 V	14		21		18			
		6 V	12		18		15			
t _{su}	Setup time, CLR inactive before CLK↓		2 V	60		90		75		ns
			4.5 V	12		18		15		
			6 V	10		15		13		

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			SN54HC4040		SN74HC4040		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}	CLK	QA	2 V		62	150		225		190	ns
			4.5 V		16	30		45		38	
			6 V		12	26		38		32	
t _{PHL}	CLR	Any	2 V		63	140		210		175	ns
			4.5 V		17	28		42		35	
			6 V		13	24		36		30	
t _t		Any	2 V		28	75		110		95	ns
			4.5 V		8	15		22		19	
			6 V		6	13		19		16	

operating characteristics, T_A = 25°C

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

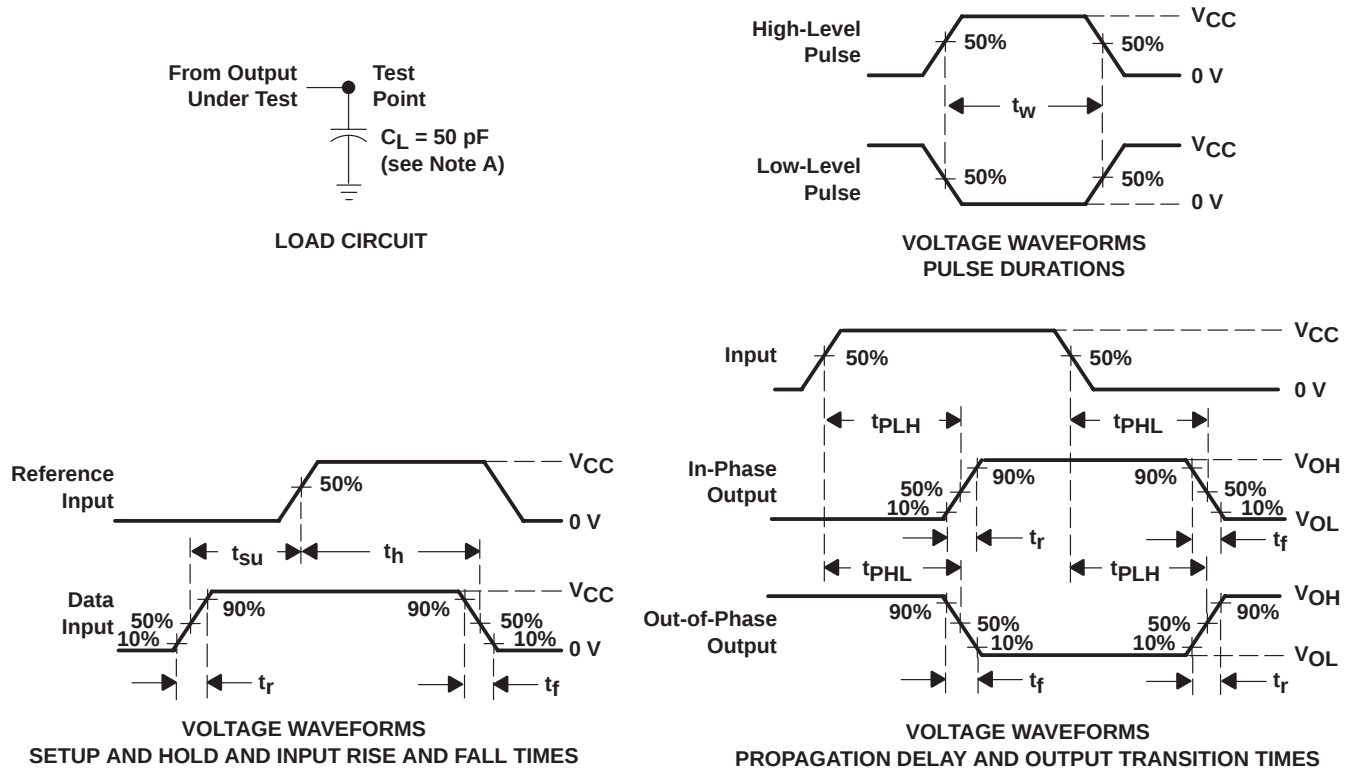


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SN54HC4040, SN74HC4040 12-BIT ASYNCHRONOUS BINARY COUNTERS

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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

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
85004012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
8500401EA	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
8500401FA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type
SN54HC4040J	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
SN74HC4040D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DBLE	OBSOLETE	SSOP	DB	16		TBD	Call TI	Call TI
SN74HC4040DBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DBRG4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DTE4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DTG4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040DWR	OBSOLETE	SOIC	DW	16		TBD	Call TI	Call TI
SN74HC4040N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74HC4040N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74HC4040NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74HC4040NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040PWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040PWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040PWLE	OBSOLETE	TSSOP	PW	16		TBD	Call TI	Call TI

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74HC4040PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040PWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040PWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040PWT	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040PWTE4	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4040PWTG4	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54HC4040FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54HC4040J	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54HC4040W	ACTIVE	CFP	W	16	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.

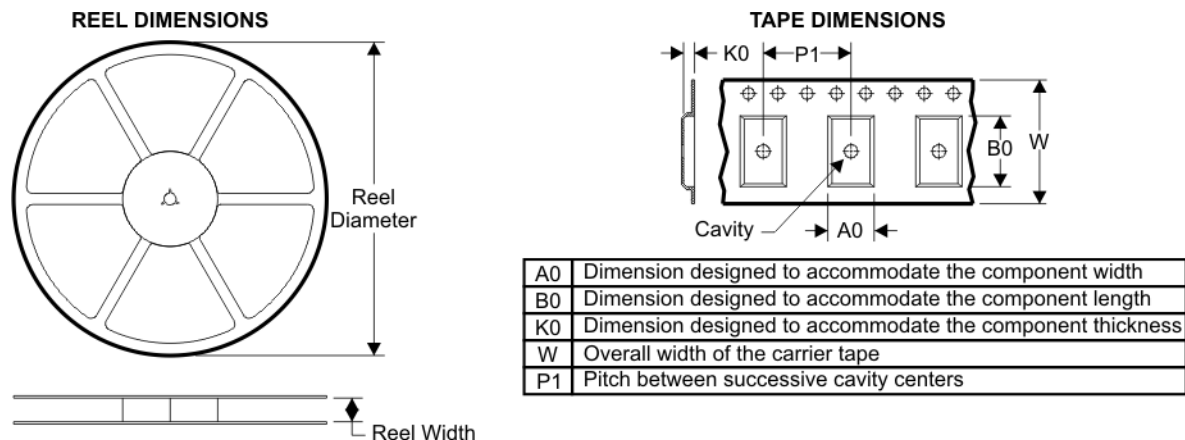
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

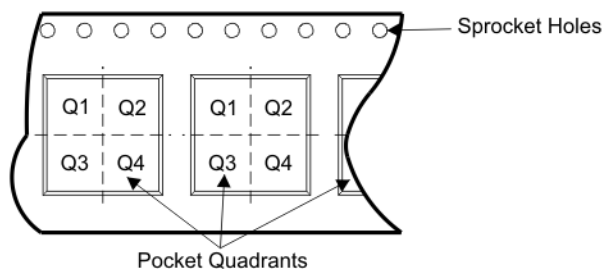
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TAPE AND REEL BOX INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package	Pins	Site	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74HC4040DBR	DB	16	SITE 41	330	16	8.2	6.6	2.5	12	16	Q1
SN74HC4040DR	D	16	SITE 27	330	16	6.5	10.3	2.1	8	16	Q1
SN74HC4040DR	D	16	SITE 41	330	16	6.5	10.3	2.1	8	16	Q1
SN74HC4040NSR	NS	16	SITE 41	330	16	8.2	10.5	2.5	12	16	Q1
SN74HC4040PWR	PW	16	SITE 41	330	12	7.0	5.6	1.6	8	12	Q1

TAPE AND REEL BOX DIMENSIONS



Device	Package	Pins	Site	Length (mm)	Width (mm)	Height (mm)
SN74HC4040DBR	DB	16	SITE 41	346.0	346.0	33.0
SN74HC4040DR	D	16	SITE 27	342.9	336.6	28.58
SN74HC4040DR	D	16	SITE 41	346.0	346.0	33.0
SN74HC4040NSR	NS	16	SITE 41	346.0	346.0	33.0
SN74HC4040PWR	PW	16	SITE 41	346.0	346.0	29.0

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	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)

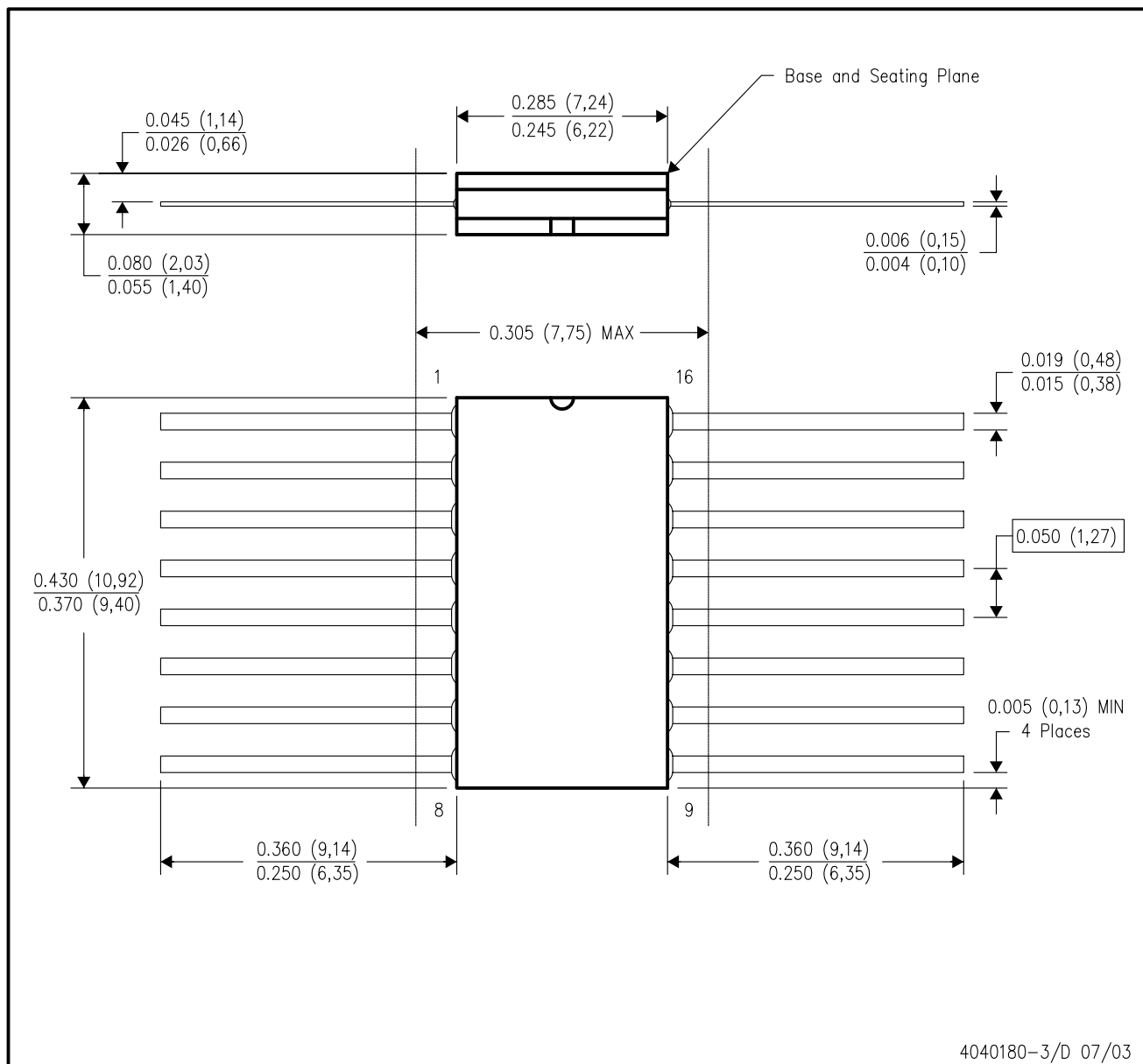


4040083/F 03/03

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

W (R-GDFP-F16)

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-F16 and JEDEC MO-092AC

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 ** DIM	14	16	18	20
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

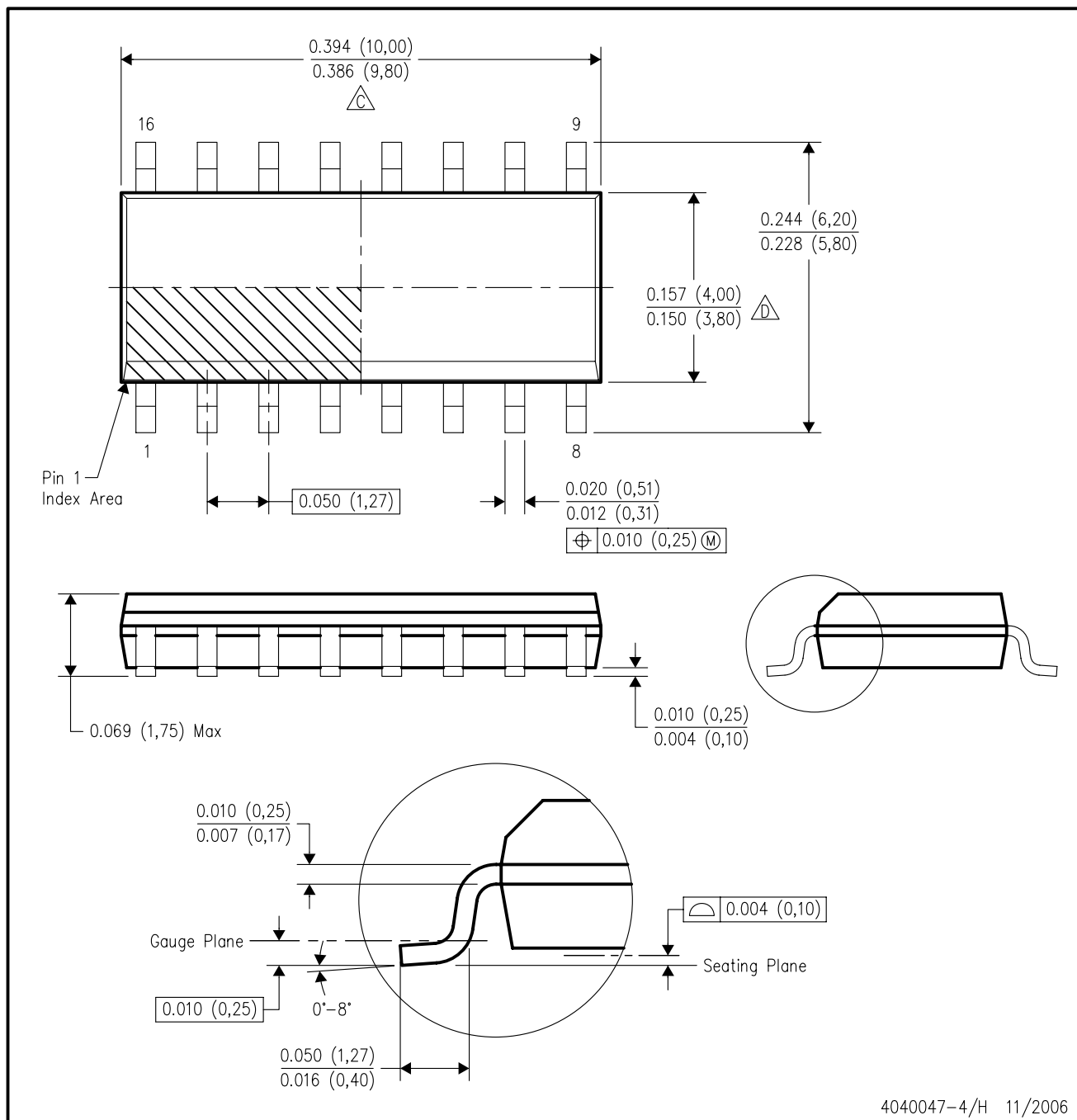


4040049/E 12/2002

- 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

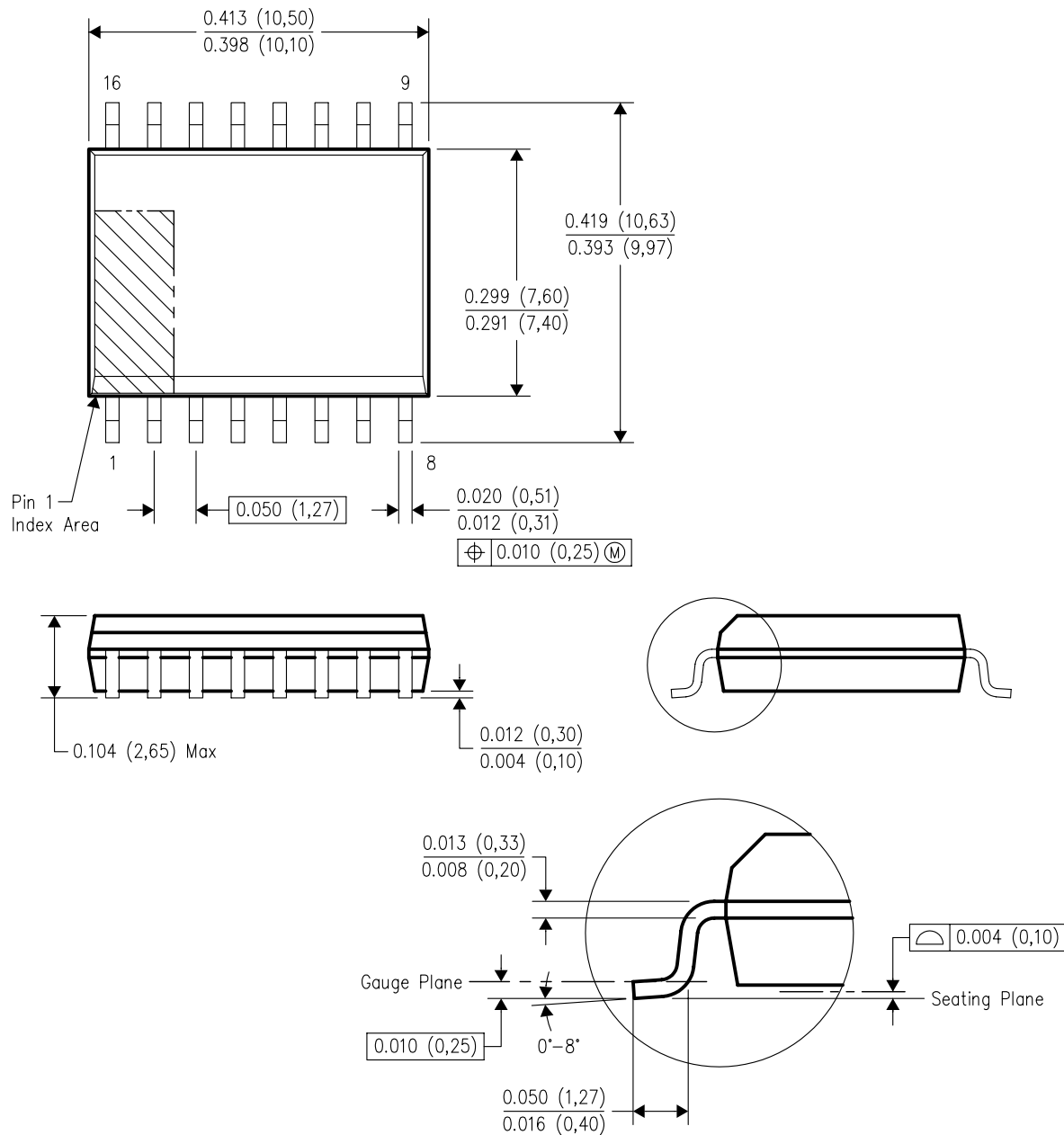


NOTES:

- 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.

DW (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



4040000-2/F 06/2004

- 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 AA.

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



- 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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Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.