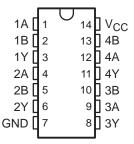
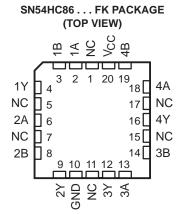
- Wide Operating Voltage Range of 2 V to 6 V
- Outputs Can Drive Up To 10 LSTTL Loads
- Low Power Consumption, 20-μA Max I_{CC}
- Typical t_{pd} = 10 ns

SN54HC86 . . . J OR W PACKAGE SN74HC86 . . . D, N, NS, OR PW PACKAGE (TOP VIEW)



- ±4-mA Output Drive at 5 V
- Low Input Current of 1 μA Max
- True Logic



NC - No internal connection

description/ordering information

These devices contain four independent 2-input exclusive-OR gates. They perform the Boolean function $Y = A \oplus B$ or $Y = \overline{AB} + A\overline{B}$ in positive logic.

A common application is as a true/complement element. If one of the inputs is low, the other input is reproduced in true form at the output. If one of the inputs is high, the signal on the other input is reproduced inverted at the output.

ORDERING INFORMATION

TA	PACKA	GE†	ORDERABLE PART NUMBER	TOP-SIDE MARKING
	PDIP – N	Tube of 25	SN74HC86N	SN74HC86N
		Tube of 50	SN74HC86D	
	SOIC - D	Reel of 2500	SN74HC86DR	HC86
-40°C to 85°C		Reel of 250	SN74HC86DT	
-40 C to 65 C	SOP - NS	Reel of 2000	SN74HC86NSR	HC86
		Tube of 90	SN74HC86PW	
	TSSOP – PW	Reel of 2000	SN74HC86PWR	HC86
		Reel of 250	SN74HC86PWT	
	CDIP – J	Tube of 25	SNJ54HC86J	SNJ54HC86J
–55°C to 125°C	CFP – W	Tube of 150	SNJ54HC86W	SNJ54HC86W
	LCCC – FK	Tube of 55	SNJ54HC86FK	SNJ54HC86FK

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



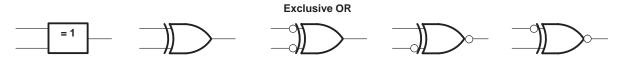
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

FUNCTION TABLE (each gate)

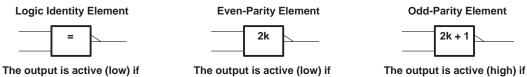
INP	UTS	OUTPUT
Α	В	Υ
L	L	L
L	Н	Н
Н	L	Н
Н	Н	L

exclusive-OR logic

An exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.



These are five equivalent exclusive-OR symbols valid for an 'HC86 gate in positive logic; negation may be shown at any two ports.



The output is active (low) if all inputs stand at the same logic level (i.e., A = B).

The output is active (low) i an even number of inputs (i.e., 0 or 2) are active.

The output is active (high) if an odd number of inputs (i.e., only 1 of the 2) are active.

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	ee Note 1)	±20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CO}$	c) (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	86°C/W
	N package	80°C/W
	NS package	76°C/W
	PW package	113°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.

SCLS100E - DECEMBER 1982 - REVISED AUGUST 2003

recommended operating conditions (see Note 3)

			S	N54HC8	6	SI	UNIT		
			MIN	NOM	MAX	MIN	NOM	MAX	UNII
Vcc	Supply voltage		2	5	6	2	5	6	V
		V _{CC} = 2 V	1.5			1.5			
VIH	High-level input voltage	V _{CC} = 4.5 V	3.15			3.15			V
		V _{CC} = 6 V	4.2			4.2			
		V _{CC} = 2 V			0.5			0.5	
VIL	Low-level input voltage	V _{CC} = 4.5 V			1.35			1.35	V
		V _{CC} = 6 V			1.8			1.8	
VI	Input voltage		0		VCC	0		VCC	V
Vo	Output voltage		0		VCC	0		VCC	V
		V _{CC} = 2 V			1000			1000	
Δt/Δν	Input transition rise/fall time	V _{CC} = 4.5 V			500			500	ns
		V _{CC} = 6 V			400			400	
TA	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)

DADAMETED	TEST CON	Vaa	T	A = 25°C	;	SN54l	1C86	SN74F	IC86	UNIT	
PARAMETER	IEST CON	VCC	MIN	TYP	MAX	MIN	MAX	MIN	MAX		
			2 V	1.9	1.998		1.9		1.9		
V _{OH} V		$I_{OH} = -20 \mu A$	4.5 V	4.4	4.499		4.4		4.4		
	VI = VIH or VIL		6 V	5.9	5.999		5.9		5.9		V
		$I_{OH} = -4 \text{ mA}$	4.5 V	3.98	4.3		3.7		3.84		
		$I_{OH} = -5.2 \text{ mA}$	6 V	5.48	5.8		5.2		5.34		
	VI = VIH or VIL		2 V		0.002	0.1		0.1		0.1	
		I _{OL} = 20 μA	4.5 V		0.001	0.1		0.1		0.1	
V _{OL}			6 V		0.001	0.1		0.1		0.1	V
		$I_{OL} = 4 \text{ mA}$	4.5 V		0.17	0.26		0.4		0.33	
		$I_{OL} = 5.2 \text{ mA}$	6 V		0.15	0.26		0.4		0.33	
lį	$V_I = V_{CC}$ or 0		6 V		±0.1	±100		±1000		±1000	nA
Icc	$V_I = V_{CC}$ or 0,	I _O = 0	6 V			2		40		20	μΑ
Ci			2 V to 6 V		3	10		10		10	pF

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

PARAMETER	FROM	TO (OUTPUT)	\/aa	T _A = 25°C			SN54HC86		SN74HC86		UNIT
PARAMETER	(INPUT)		VCC	MIN	TYP	MAX	MIN	MAX	MIN	MAX	UNIT
t _{pd} A or B			2 V		40	100		150		125	
	A or B	Y	Υ	4.5 V		12	20		30		25
			6 V		10	17		25		21	i I
			2 V		28	75		110		95	
t _t		Υ	4.5 V		8	15		22		19	ns
			6 V		6	13		19		16	

operating characteristics, T_A = 25°C

	PARAMETER	TEST CONDITIONS	TYP	UNIT
C _{pd}	Power dissipation capacitance per gate	No load	35	pF

PARAMETER MEASUREMENT INFORMATION **From Output** Test Input 50% 50% **Under Test Point** $C_L = 50 pF$ tPLH -^tPHL (see Note A) v_{OH} In-Phase Output **LOAD CIRCUIT** 10% - tPHL VCC ۷он 90% Input 90% **Out-of-Phase** Output **VOLTAGE WAVEFORM VOLTAGE WAVEFORMS INPUT RISE AND FALL TIMES** PROPAGATION DELAY AND OUTPUT TRANSITION TIMES

- NOTES: A. C_I 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 Ω , t_f = 6 ns, t_f = 6 ns.
 - C. The outputs are measured one at a time with one input transition per measurement.
 - D. tpLH and tpHL are the same as tpd.

Figure 1. Load Circuit and Voltage Waveforms





PACKAGE OPTION ADDENDUM

www.ti.com 15-Oct-2009

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-8404601VCA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type
5962-8404601VDA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
84046012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
8404601CA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type
8404601DA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
JM38510/65202BCA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type
SN54HC86J	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type
SN74HC86D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86DRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86DT	ACTIVE	SOIC	D	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86DTE4	ACTIVE	SOIC	D	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86DTG4	ACTIVE	SOIC	D	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74HC86NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74HC86NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86NSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86NSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86PW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86PWE4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86PWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86PWLE	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI
SN74HC86PWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86PWRE4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86PWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM



PACKAGE OPTION ADDENDUM

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Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	e Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74HC86PWT	ACTIVE	TSSOP	PW	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86PWTE4	ACTIVE	TSSOP	PW	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC86PWTG4	ACTIVE	TSSOP	PW	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54HC86FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54HC86J	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type
SNJ54HC86W	ACTIVE	CFP	W	14	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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OTHER QUALIFIED VERSIONS OF SN54HC86, SN54HC86-SP, SN74HC86:

Automotive: SN74HC86-Q1

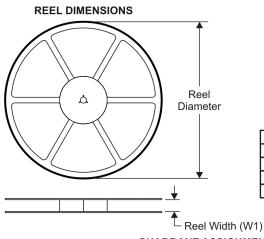
NOTE: Qualified Version Definitions:

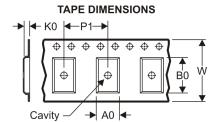
Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

15-Oct-2009

www.ti.com 28-Feb-2011

TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
В0	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

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

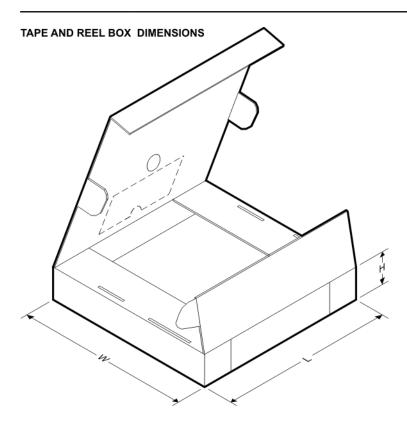


*All dimensions are nominal

All dimensions are nomina	l											
Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74HC86DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74HC86DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74HC86DT	SOIC	D	14	250	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74HC86NSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74HC86PWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74HC86PWT	TSSOP	PW	14	250	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1



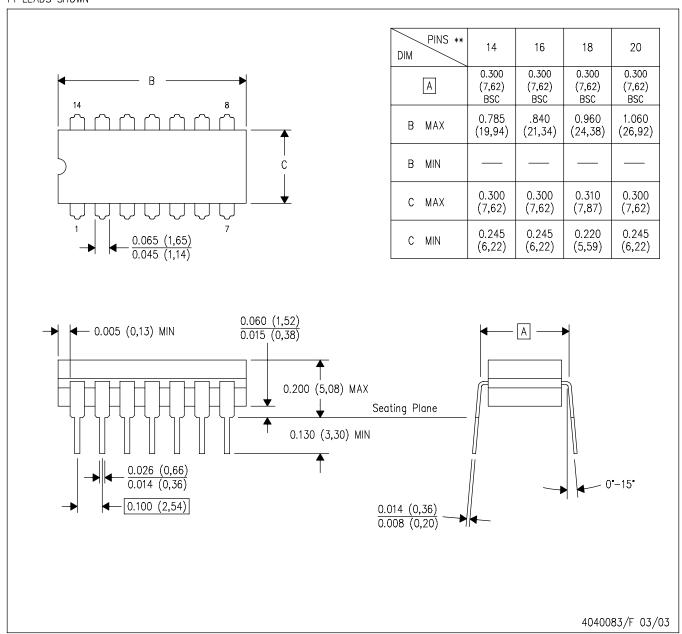
www.ti.com 28-Feb-2011



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74HC86DR	SOIC	D	14	2500	346.0	346.0	33.0
SN74HC86DR	SOIC	D	14	2500	333.2	345.9	28.6
SN74HC86DT	SOIC	D	14	250	346.0	346.0	33.0
SN74HC86NSR	SO	NS	14	2000	346.0	346.0	33.0
SN74HC86PWR	TSSOP	PW	14	2000	346.0	346.0	29.0
SN74HC86PWT	TSSOP	PW	14	250	346.0	346.0	29.0

14 LEADS SHOWN



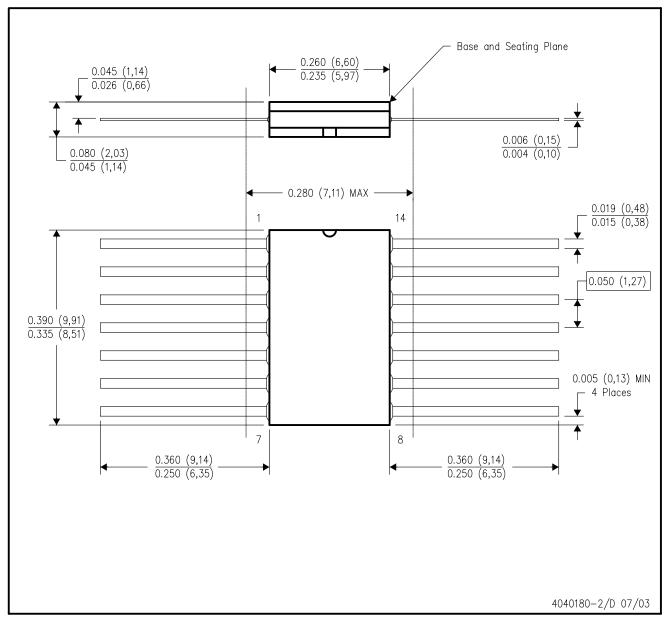
NOTES:

- 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.

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W (R-GDFP-F14)

CERAMIC DUAL FLATPACK

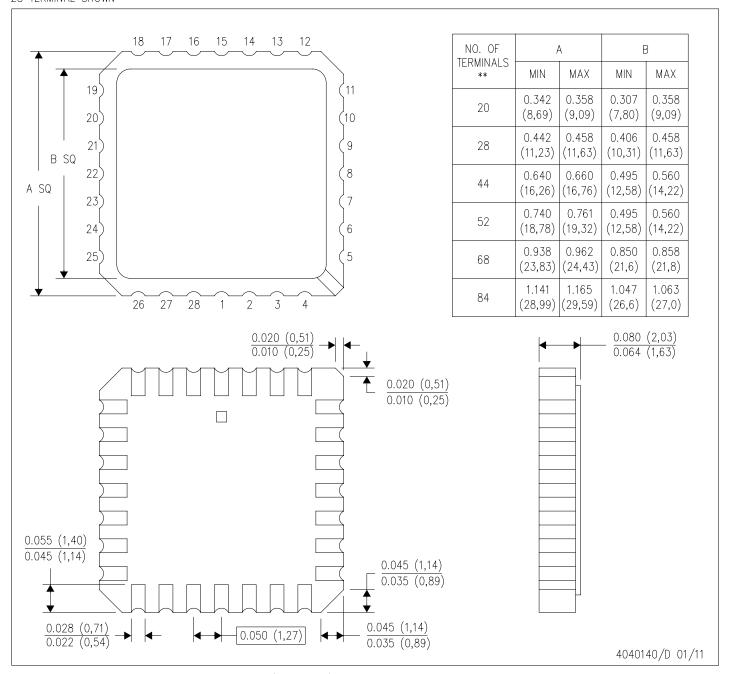


- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only.
- E. Falls within MIL STD 1835 GDFP1-F14 and JEDEC MO-092AB

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN

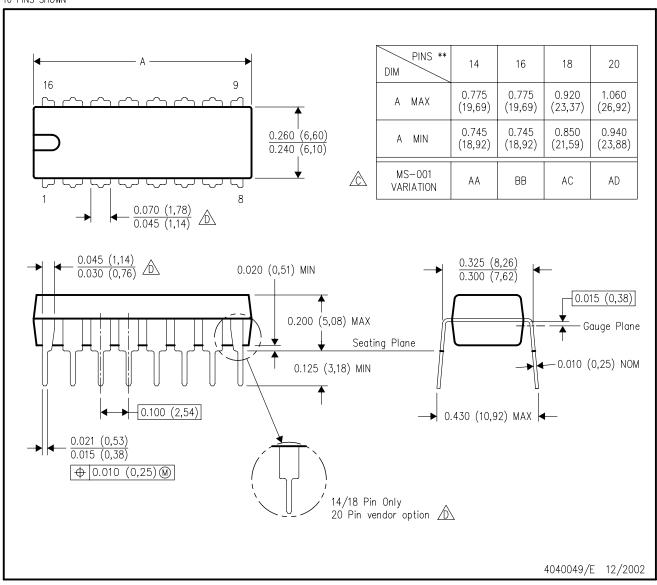


- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a metal lid.
- D. Falls within JEDEC MS-004

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

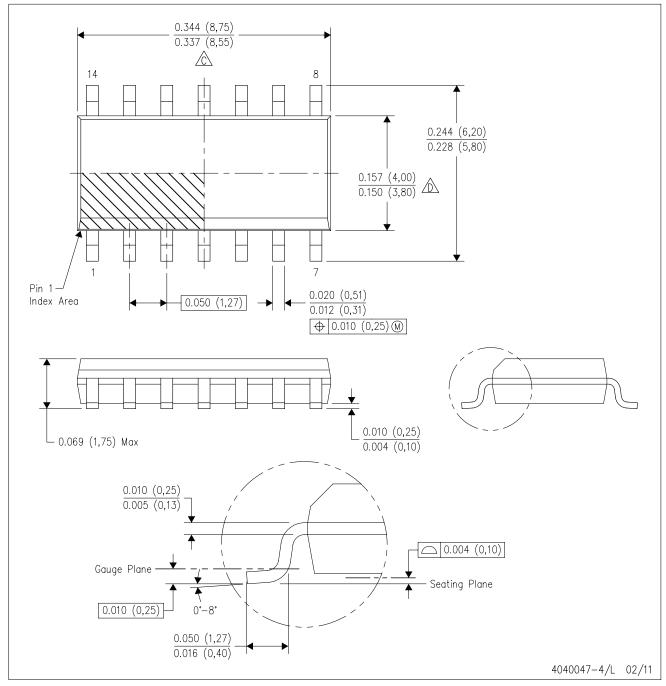
16 PINS SHOWN



- 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-G14)

PLASTIC SMALL OUTLINE

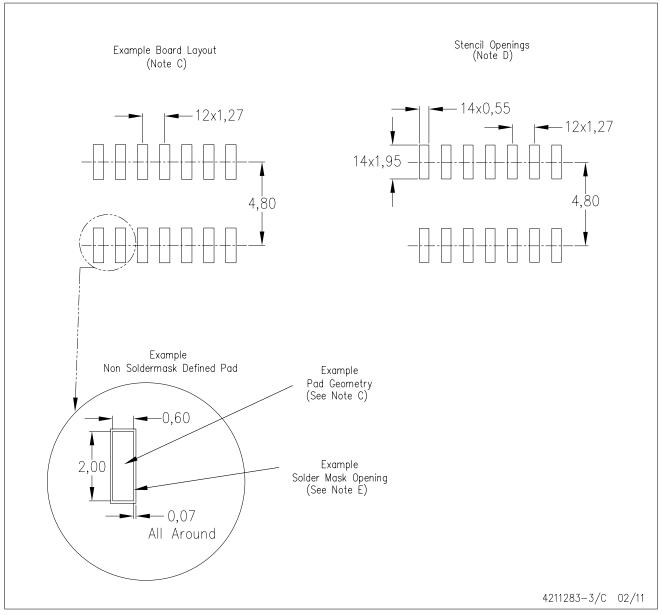


- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- Body width does not include interlead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



D (R-PDSO-G14)

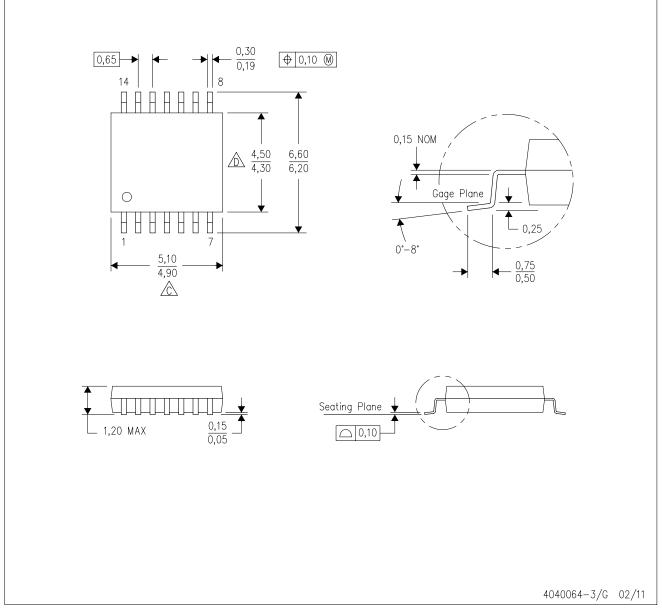
PLASTIC SMALL OUTLINE



- 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.

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



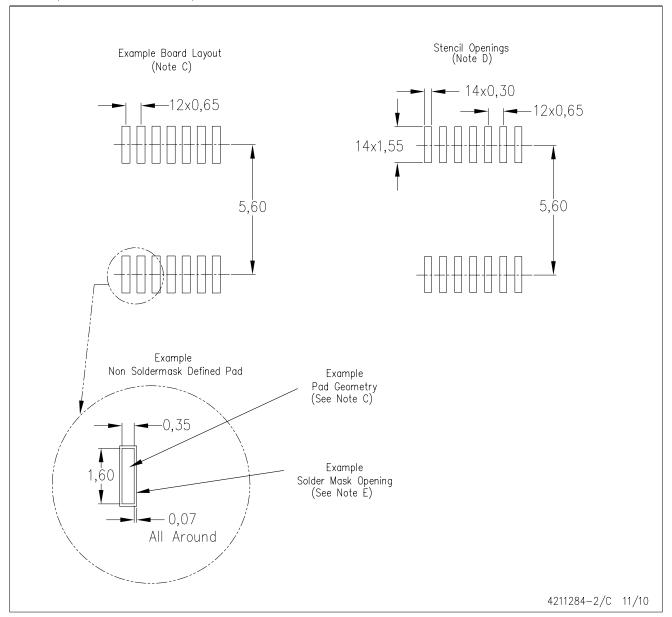
NOTES: A.

- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M—1994.
- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
- E. Falls within JEDEC MO-153



PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



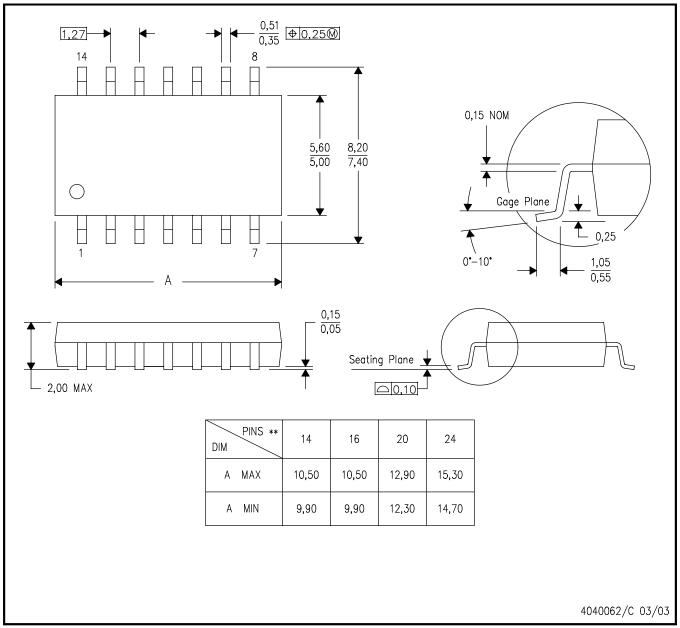
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact 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.

MECHANICAL DATA

NS (R-PDSO-G**)

14-PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



- 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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