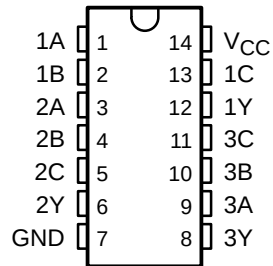


SN54ALS11A, SN54AS11, SN74ALS11A, SN74AS11 TRIPLE 3-INPUT POSITIVE-AND GATES

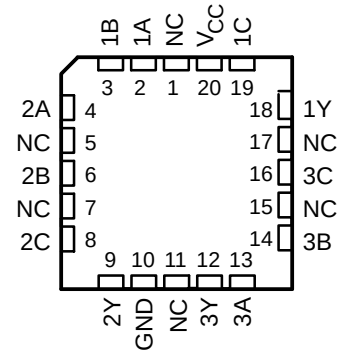
SDAS009D – MARCH 1984 – REVISED NOVEMBER 2002

- 4.5-V to 5.5-V V_{CC} Operation
- Max t_{pd} of 5.5 ns at 5 V

SN54ALS11A, ... J OR W PACKAGE
SN54AS11 ... J PACKAGE
SN74ALS11A, SN74AS11 ... D, N, OR NS PACKAGE
(TOP VIEW)



SN54ALS11A, SN54AS11 ... FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

These devices contain three independent 3-input positive-AND gates. They perform the Boolean functions $Y = A \cdot B \cdot C$ or $Y = \overline{A} + \overline{B} + \overline{C}$ in positive logic.

ORDERING INFORMATION

T_A	PACKAGE [†]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP – N	Tube	SN74ALS11AN	SN74ALS11AN
			SN74AS11N	SN74AS11N
	SOIC – D	Tube	SN74ALS11AD	ALS11A
		Tape and reel	SN74ALS11ADR	
		Tube	SN74AS11D	AS11
		Tape and reel	SN74AS11DR	
	SOP – NS	Tape and reel	SN74ALS11ANSR	ALS11A
			SN74AS11NSR	74AS11
–55°C to 125°C	CDIP – J	Tube	SNJ54ALS11AJ	SNJ54ALS11AJ
			SNJ54AS11J	SNJ54AS11J
	CFP – W	Tube	SNJ54ALS11AW	SNJ54ALS11AW
	LCCC – FK	Tube	SNJ54ALS11AFK	SNJ54ALS11AFK
			SNJ54AS11FK	SNJ54AS11FK

[†] 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
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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.

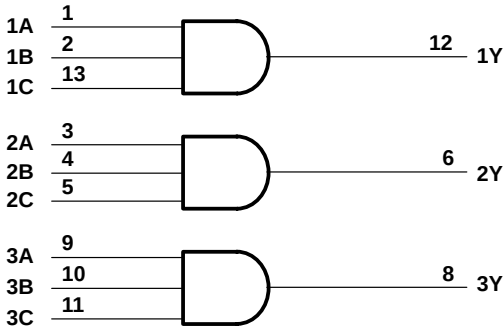
SN54ALS11A, SN54AS11, SN74ALS11A, SN74AS11
TRIPLE 3-INPUT POSITIVE-AND GATES

SDAS009D – MARCH 1984 – REVISED NOVEMBER 2002

FUNCTION TABLE
(each gate)

INPUTS			OUTPUT Y
A	B	C	
H	H	H	H
L	X	X	L
X	L	X	L
X	X	L	L

logic diagram, each gate (positive logic)



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

absolute maximum ratings over operating free-air temperature range (SN54ALS11A, SN74ALS11A) (unless otherwise noted)[†]

Supply voltage, V_{CC}	7 V
Input voltage, V_I	7 V
Package thermal impedance, θ_{JA} (see Note 1): D package	86°C/W
N package	80°C/W
NS package	76°C/W
Storage temperature range	–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.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 2)

		SN54ALS11A			SN74ALS11A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.8 [‡]			0.8	V
				0.7 [§]				
I_{OH}	High-level output current			–0.4			–0.4	mA
I_{OL}	Low-level output current			4			8	mA
T_A	Operating free-air temperature	–55		125	0		70	°C

[‡] Applies over temperature range –55°C to 70°C

[§] Applies over temperature range 70°C to 125°C

NOTE 2: 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.



SN54ALS11A, SN54AS11, SN74ALS11A, SN74AS11 TRIPLE 3-INPUT POSITIVE-AND GATES

SDAS009D – MARCH 1984 – REVISED NOVEMBER 2002

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

PARAMETER	TEST CONDITIONS		SN54ALS11A		SN74ALS11A		UNIT
			MIN	TYP†	MAX	MIN	
V _{IK}	V _{CC} = 4.5 V, I _I = −18 mA		−1.5		−1.5		V
V _{OH}	V _{CC} = 4.5 V to 5.5 V, I _{OH} = −0.4 mA		V _{CC} − 2		V _{CC} − 2		V
V _{OL}	V _{CC} = 4.5 V	I _{OL} = 4 mA	0.25	0.4	0.25	0.4	V
		I _{OL} = 8 mA			0.35	0.5	
I _I	V _{CC} = 5.5 V,	V _I = 7 V	0.1		0.1		mA
I _{IH}	V _{CC} = 5.5 V,	V _I = 2.7 V	20		20		μA
I _{IL}	V _{CC} = 5.5 V,	V _I = 0.4 V	−0.1		−0.1		mA
I _O ‡	V _{CC} = 5.5 V,	V _O = 2.25 V	−20	−112	−30	−112	mA
I _{CCH}	V _{CC} = 5.5 V,	V _I = 4.5 V	1	1.8	1	1.8	mA
I _{CCL}	V _{CC} = 5.5 V,	V _I = 0	1.6	3	1.6	3	mA

[†] All typical values are at $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$.

[‡] The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS} .

switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V TO 5.5 V, C _L = 50 pF, R _L = 500 Ω, T _A = MIN TO MAX§				UNIT
			SN54ALS11A		SN74ALS11A		
			MIN	MAX	MIN	MAX	
t _{PLH}	A, B, or C	Y	2	14	2	13	ns
t _{PHL}			2	12.5	2	10	

^{\S} For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

absolute maximum ratings over operating free-air temperature range (SN54AS11, SN74AS11) (unless otherwise noted)[¶]

Supply voltage, V_{CC} 7 V

Input voltage, V_I 7 V

Package thermal impedance, θ_{JA} (see Note 1): D package 86°C/W

N package 80°C/W

NS package 76°C/W

Storage temperature range -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.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51-7.



SN54ALS11A, SN54AS11, SN74ALS11A, SN74AS11

TRIPLE 3-INPUT POSITIVE-AND GATES

SDAS009D – MARCH 1984 – REVISED NOVEMBER 2002

recommended operating conditions (see Note 2)

		SN54AS11			SN74AS11			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V _{IH}	High-level input voltage	2			2			V
V _{IL}	Low-level input voltage			0.8			0.8	V
I _{OH}	High-level output current			–2			–2	mA
I _{OL}	Low-level output current			20			20	mA
T _A	Operating free-air temperature	–55		125	0		70	°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	SN54AS11			SN74AS11			UNIT
		MIN	TYP [†]	MAX	MIN	TYP [†]	MAX	
V _{IK}	V _{CC} = 4.5 V, I _I = –18 mA			–1.2			–1.2	V
V _{OH}	V _{CC} = 4.5 V to 5.5 V, I _{OH} = –2 mA	V _{CC} –2			V _{CC} –2			V
V _{OL}	V _{CC} = 4.5 V, I _{OL} = 20 mA		0.35	0.5		0.35	0.5	V
I _I	V _{CC} = 5.5 V, V _I = 7 V			0.1			0.1	mA
I _{IH}	V _{CC} = 5.5 V, V _I = 2.7 V			20			20	μA
I _{IL}	V _{CC} = 5.5 V, V _I = 0.4 V			–0.5			–0.5	mA
I _O [‡]	V _{CC} = 5.5 V, V _O = 2.25 V	–30		–112	–30		–112	mA
I _{CCH}	V _{CC} = 5.5 V, V _I = 4.5 V		4.3	7		4.3	7	mA
I _{CCL}	V _{CC} = 5.5 V, V _I = 0		11.2	18		11.2	18	mA

[†] All typical values are at V_{CC} = 5 V, T_A = 25°C.

[‡] The output conditions have been chosen to produce a current that closely approximates one-half of the true short-circuit output current, I_{OS}.

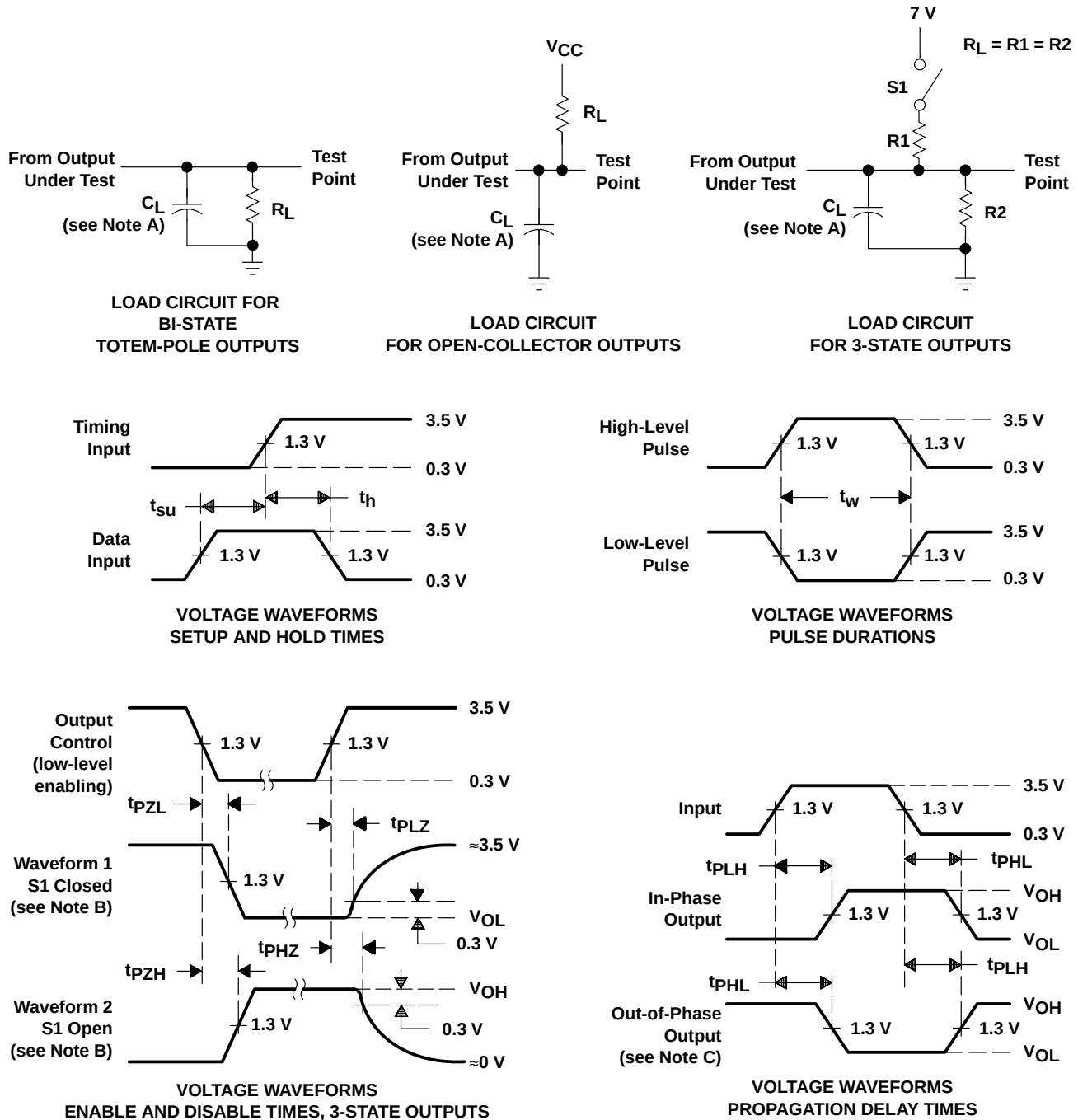
switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V TO 5.5 V, C _L = 50 PF, R _L = 500 Ω, T _A = MIN TO MAX§				UNIT
			SN54AS11		SN74AS11		
			MIN	MAX	MIN	MAX	
t _{PLH}	A, B, or C	Y	1	6.5	1	6	ns
t _{PHL}			1	6.5	1	5.5	

[§] For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.



PARAMETER MEASUREMENT INFORMATION
SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



- 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. When measuring propagation delay items of 3-state outputs, switch S1 is open.
D. All input pulses have the following characteristics: $PRR \leq 1$ MHz, $t_r = t_f = 2$ ns, duty cycle = 50%.
E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

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
5962-86841012A	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 86841012A SNJ54ALS 11AFK	Samples
5962-8684101CA	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8684101CA SNJ54ALS11AJ	Samples
5962-8684101DA	ACTIVE	CFP	W	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8684101DA SNJ54ALS11AW	Samples
5962-9756101QCA	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9756101QC A SNJ54AS11J	Samples
JM38510/37402BCA	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 37402BCA	Samples
M38510/37402BCA	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 37402BCA	Samples
SN54ALS11AJ	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SN54ALS11AJ	Samples
SN54AS11J	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SN54AS11J	Samples
SN74ALS11AD	ACTIVE	SOIC	D	14	50	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS11A	Samples
SN74ALS11ADR	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS11A	Samples
SN74ALS11ADRG4	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS11A	Samples
SN74ALS11AN	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74ALS11AN	Samples
SN74ALS11ANSR	ACTIVE	SO	NS	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS11A	Samples
SN74AS11D	ACTIVE	SOIC	D	14	50	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	AS11	Samples
SN74AS11N	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74AS11N	Samples
SNJ54ALS11AFK	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 86841012A SNJ54ALS 11AFK	Samples

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
SNJ54ALS11AJ	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8684101CA SNJ54ALS11AJ	Samples
SNJ54ALS11AW	ACTIVE	CFP	W	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8684101DA SNJ54ALS11AW	Samples
SNJ54AS11J	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9756101QC A SNJ54AS11J	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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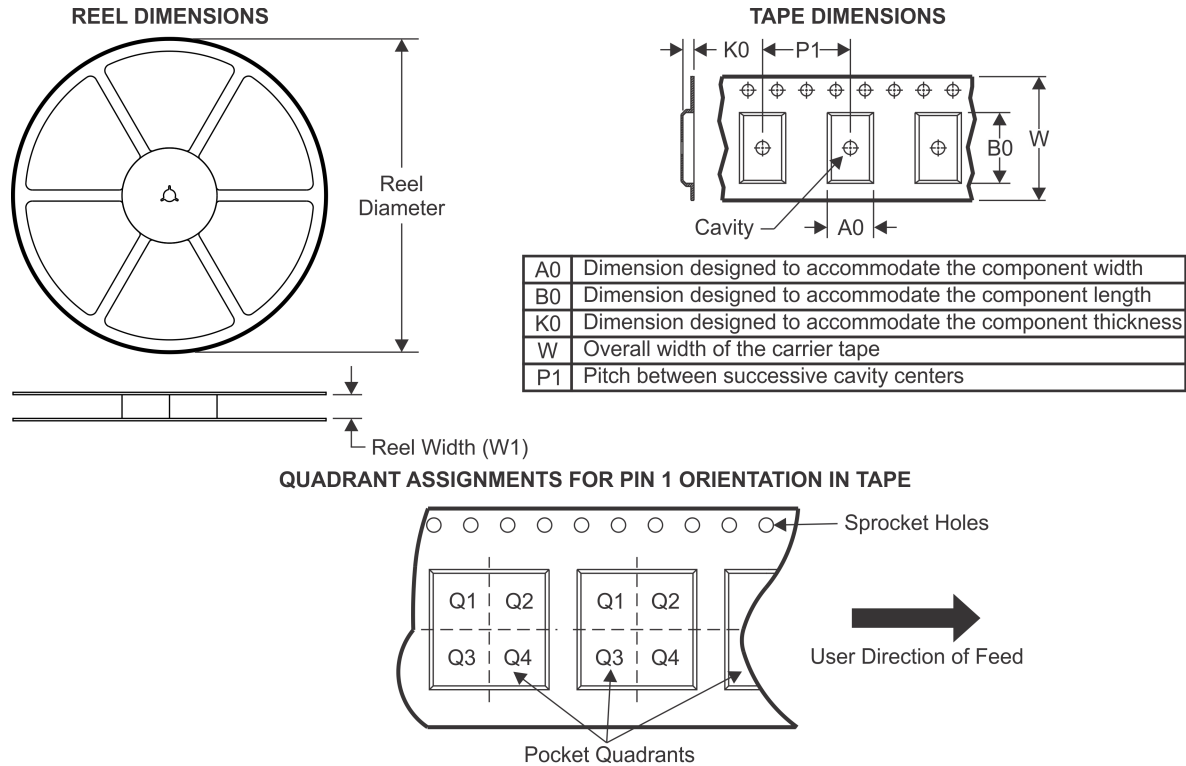
OTHER QUALIFIED VERSIONS OF SN54ALS11A, SN54AS11, SN74ALS11A, SN74AS11 :

- Catalog : [SN74ALS11A](#), [SN74AS11](#)
- Military : [SN54ALS11A](#), [SN54AS11](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

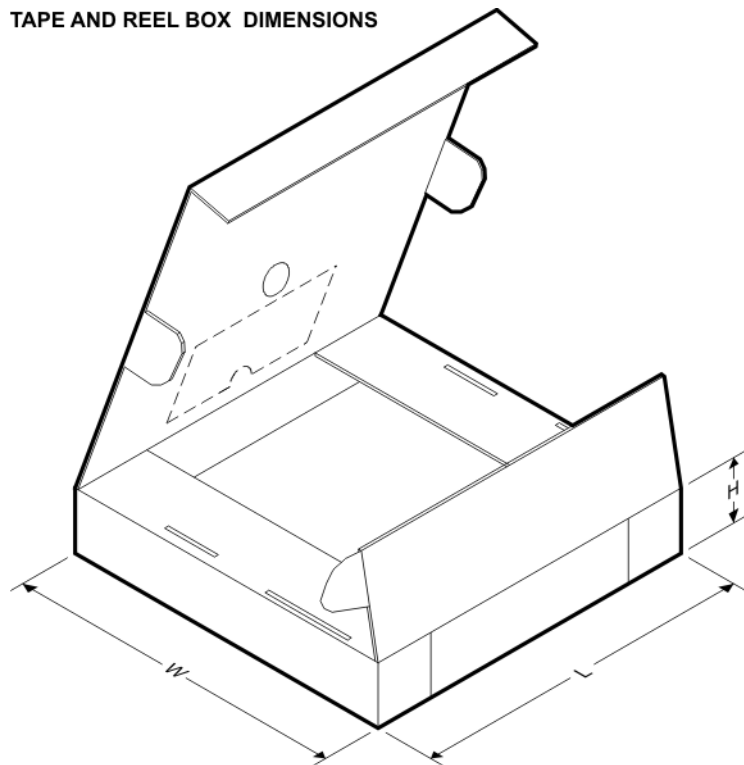
TAPE AND REEL INFORMATION



*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
SN74ALS11ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74ALS11ANSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

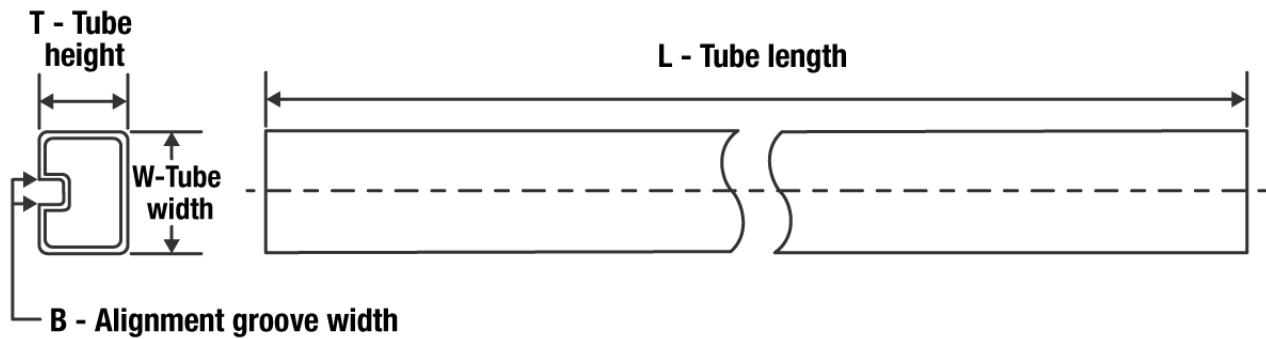
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALS11ADR	SOIC	D	14	2500	853.0	449.0	35.0
SN74ALS11ANSR	SO	NS	14	2000	853.0	449.0	35.0

TUBE

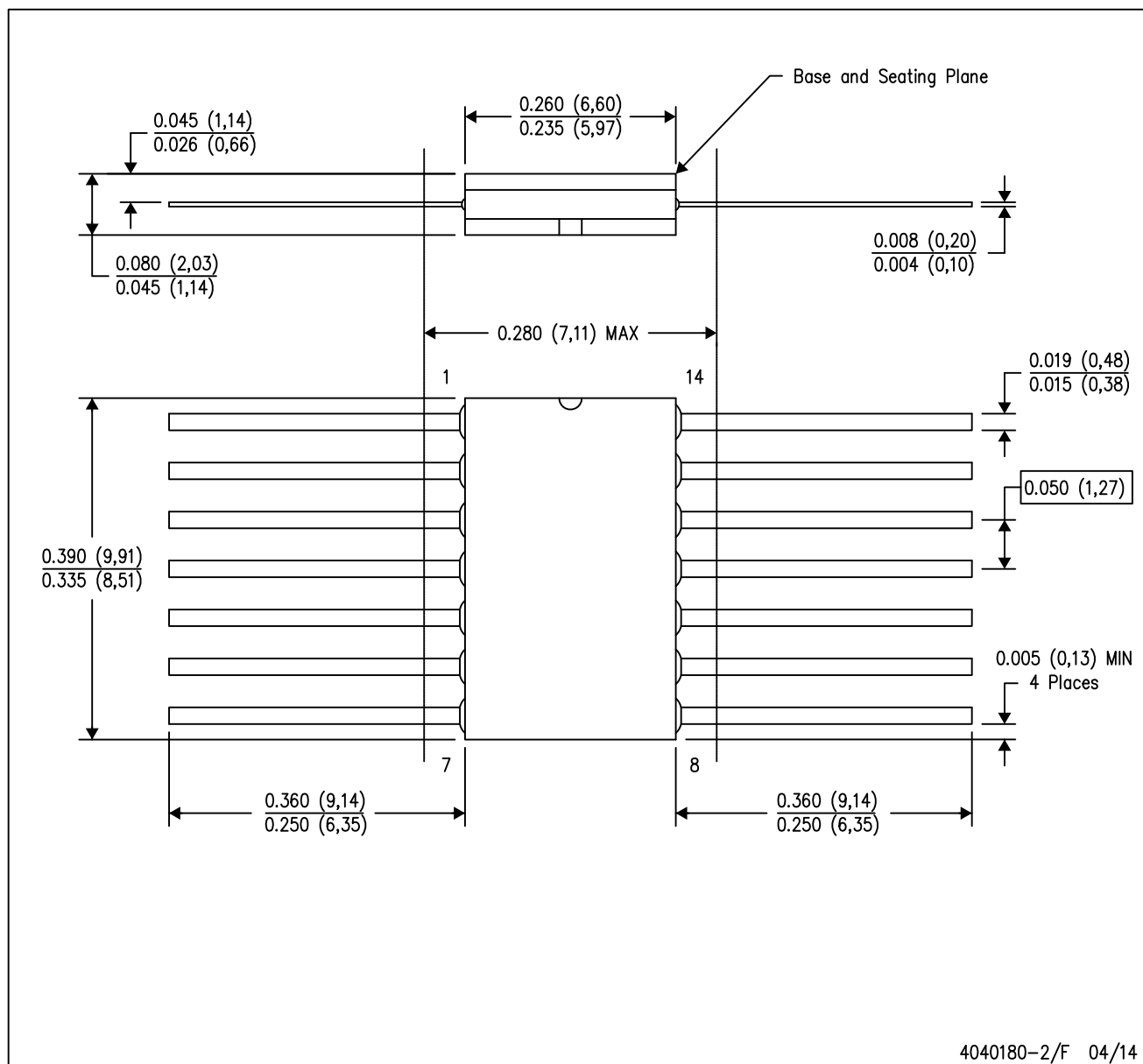


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-86841012A	FK	LCCC	20	1	506.98	12.06	2030	NA
SN74ALS11AD	D	SOIC	14	50	506.6	8	3940	4.32
SN74ALS11AN	N	PDIP	14	25	506	13.97	11230	4.32
SN74ALS11AN	N	PDIP	14	25	506	13.97	11230	4.32
SN74AS11D	D	SOIC	14	50	506.6	8	3940	4.32
SN74AS11N	N	PDIP	14	25	506	13.97	11230	4.32
SN74AS11N	N	PDIP	14	25	506	13.97	11230	4.32
SNJ54ALS11AFK	FK	LCCC	20	1	506.98	12.06	2030	NA

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



NOTES:

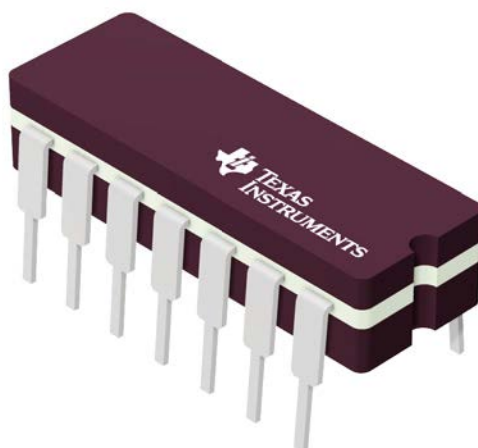
- All linear dimensions are in inches (millimeters).
- This drawing is subject to change without notice.
- This package can be hermetically sealed with a ceramic lid using glass frit.
- Index point is provided on cap for terminal identification only.
- Falls within MIL STD 1835 GDFP1-F14

J 14

GENERIC PACKAGE VIEW

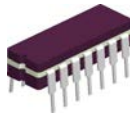
CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE

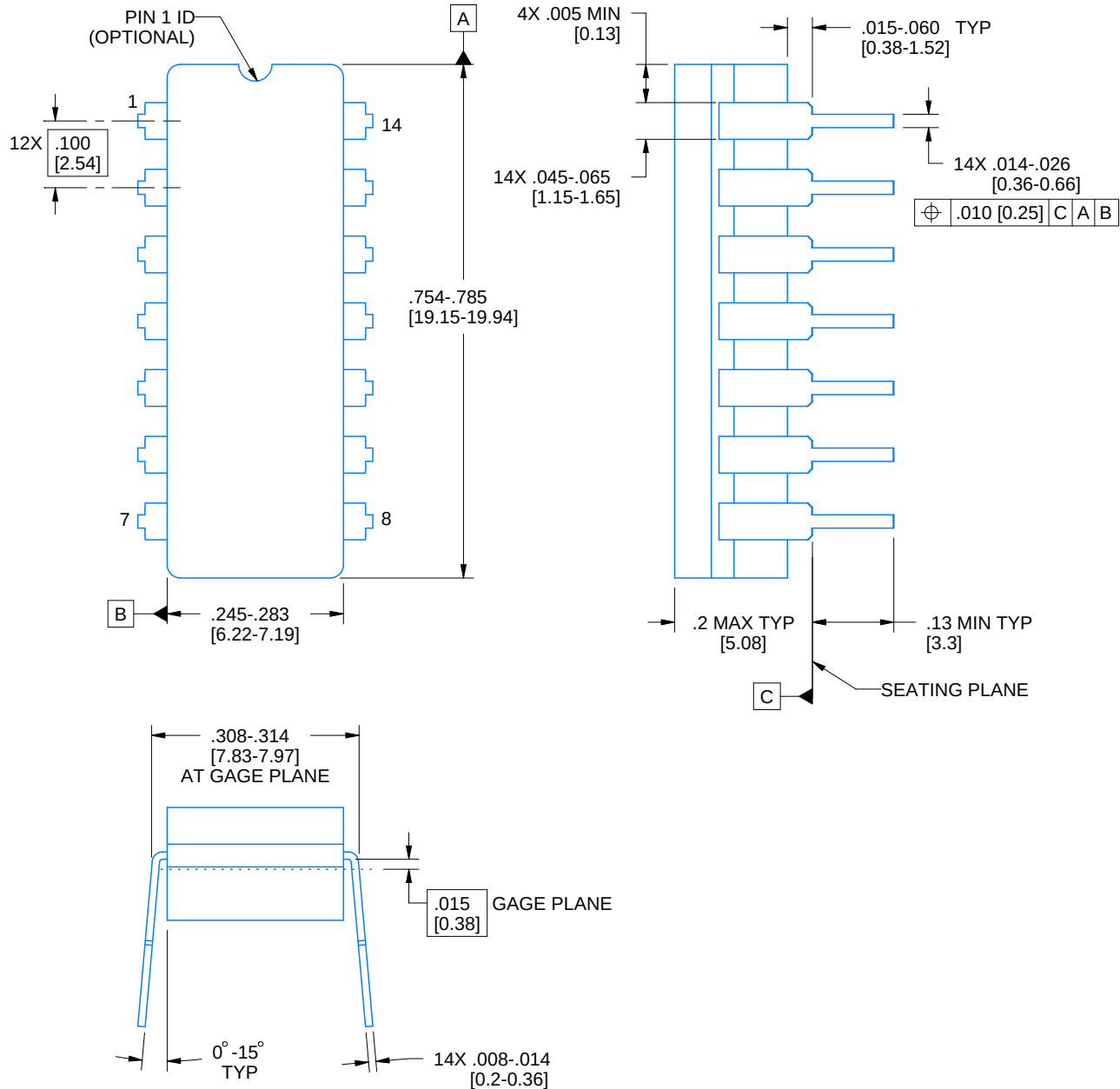


Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4040083-5/G

J0014A**PACKAGE OUTLINE****CDIP - 5.08 mm max height**

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

NOTES:

1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.



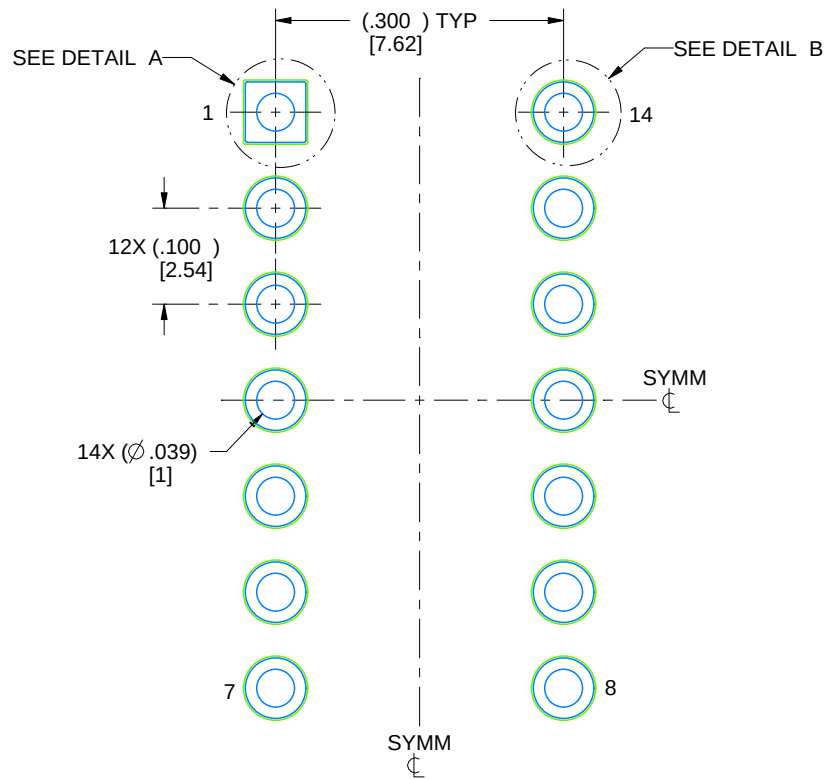
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EXAMPLE BOARD LAYOUT

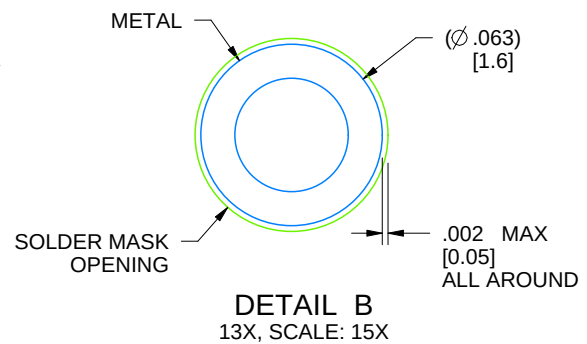
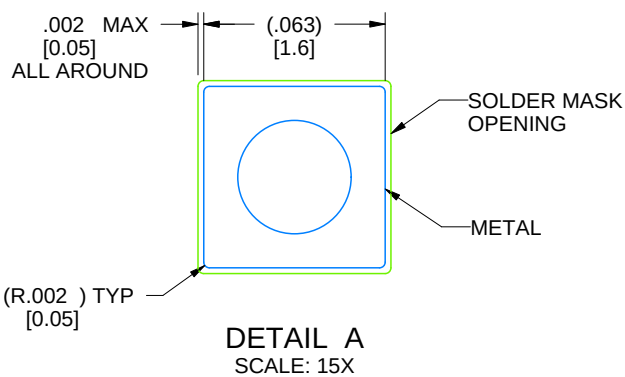
J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE: 5X

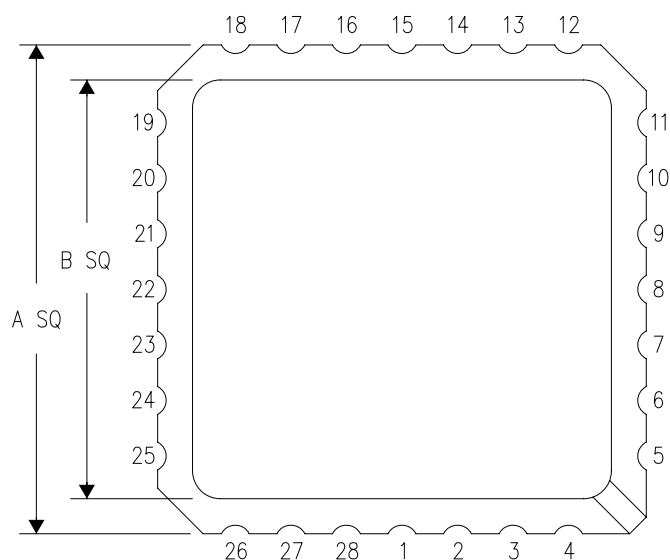


4214771/A 05/2017

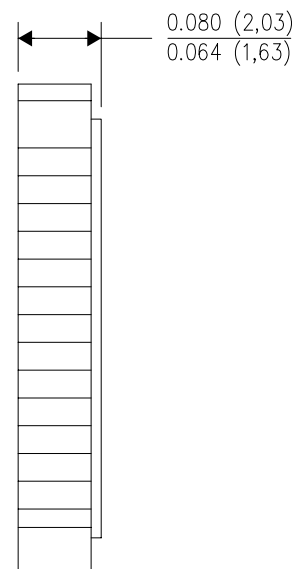
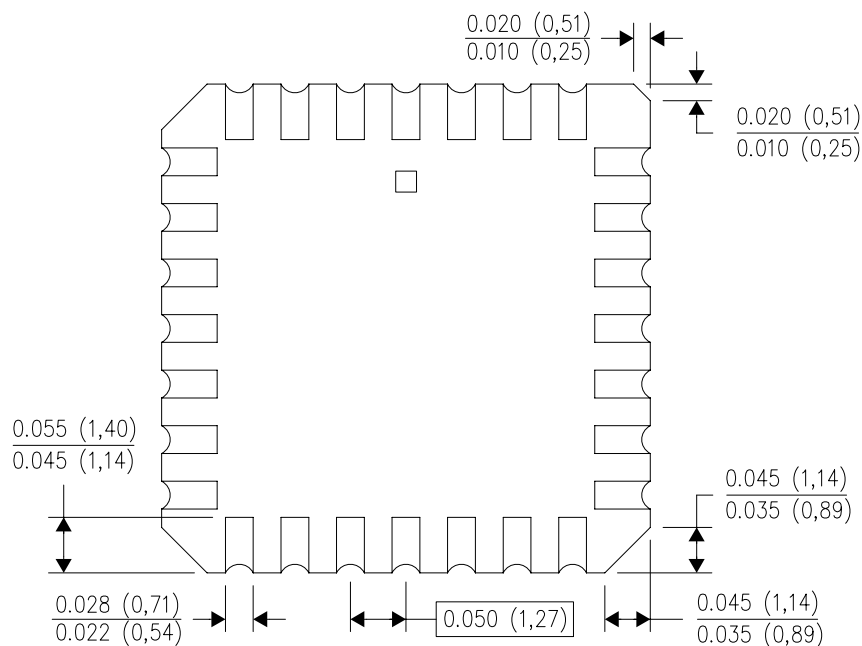
FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



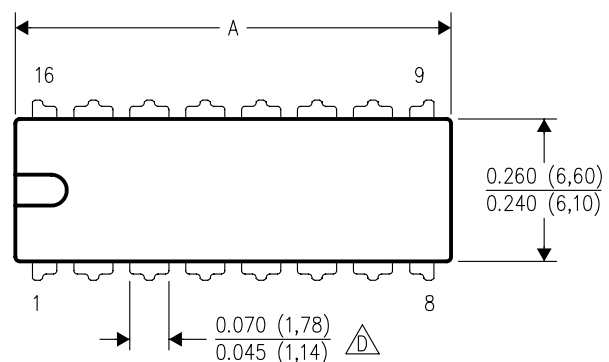
4040140/D 01/11

- 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.
 - Falls within JEDEC MS-004

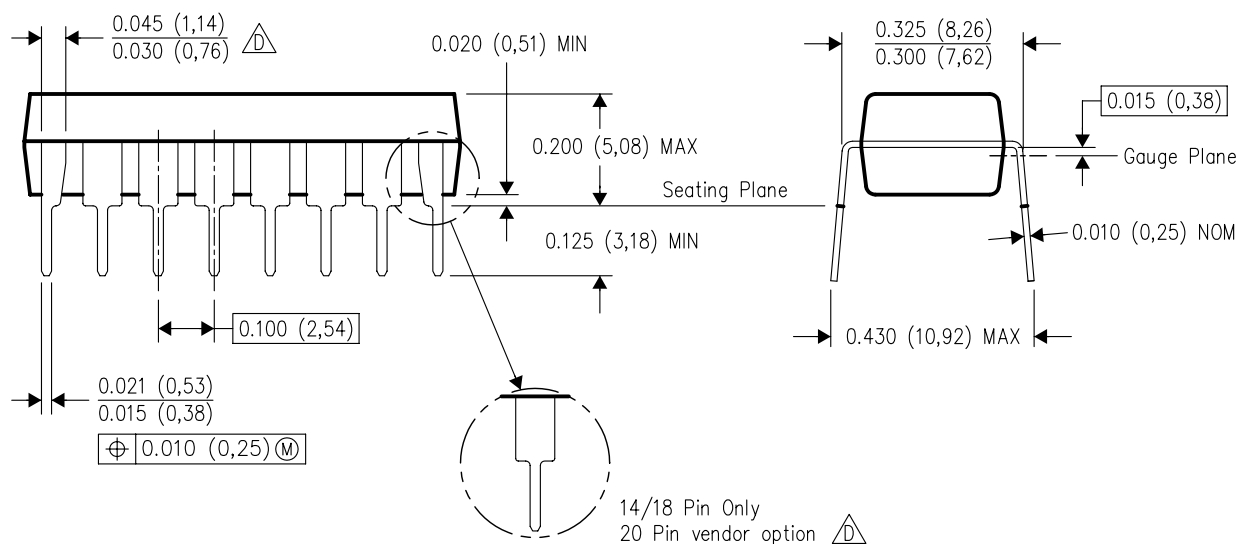
N (R-PDIP-T**)

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



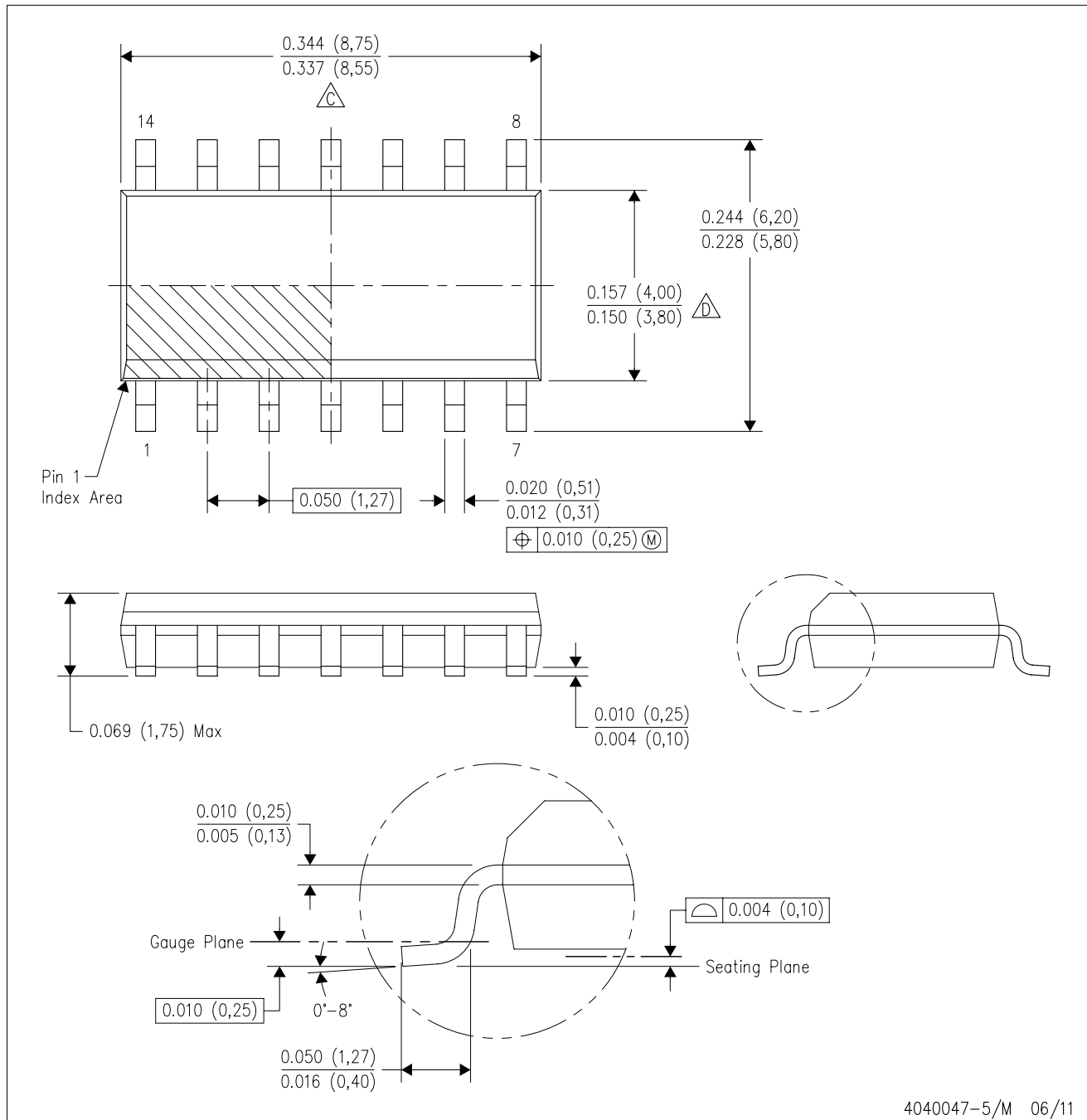
4040049/E 12/2002

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-G14)

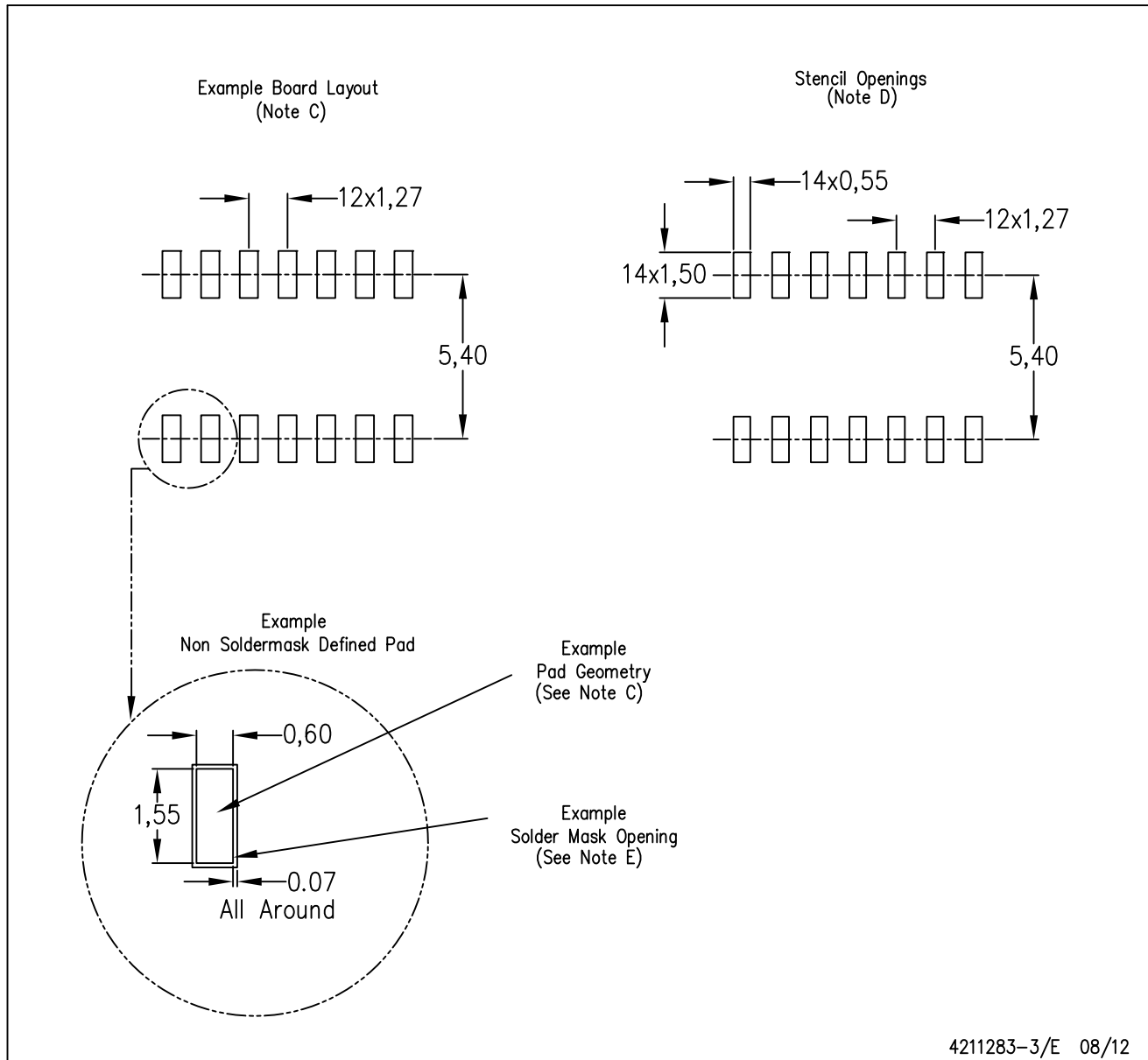
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - $\triangle C$ 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.
 - $\triangle D$ Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



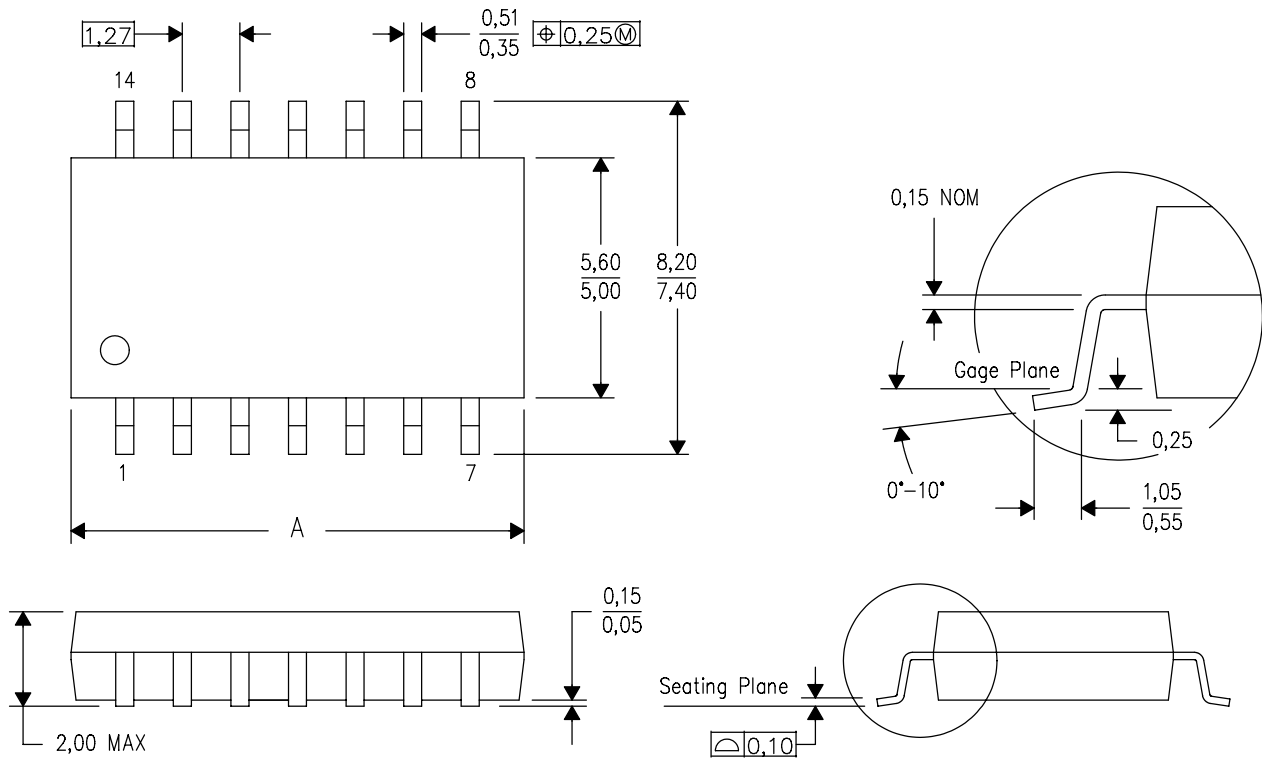
- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should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

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.

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