

SN54ALS640B, SN54AS640, SN74ALS640B, SN74AS640 OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SDAS122A – DECEMBER 1983 – REVISED JANUARY 1995

- Bidirectional Bus Transceivers in High-Density 20-Pin Packages
- Inverting Logic
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

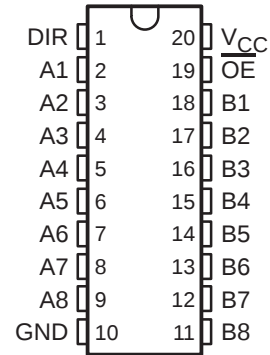
description

These octal bus transceivers are designed for asynchronous two-way communication between data buses. These devices transmit data from the A bus to the B bus or from the B bus to the A bus, depending upon the level at the direction-control (DIR) input. The output-enable ($\overline{OE}$) input can be used to disable the device so that the buses are effectively isolated.

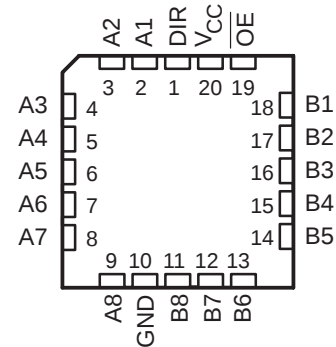
The -1 version of the SN74ALS640B is identical to the standard version, except that the recommended maximum I_{OL} for the -1 version is increased to 48 mA. There is no -1 version of the SN54ALS640B.

The SN54ALS640B and SN54AS640 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ALS640B and SN74AS640 are characterized for operation from 0°C to 70°C .

SN54ALS640B, SN54AS640 . . . J PACKAGE
SN74ALS640B, SN74AS640 . . . DW OR N PACKAGE
(TOP VIEW)



SN54ALS640B, SN54AS640 . . . FK PACKAGE
(TOP VIEW)



FUNCTION TABLE

INPUTS		OPERATION
$\overline{OE}$	DIR	
L	L	$\overline{B}$ data to A bus
L	H	$\overline{A}$ data to B bus
H	X	Isolation

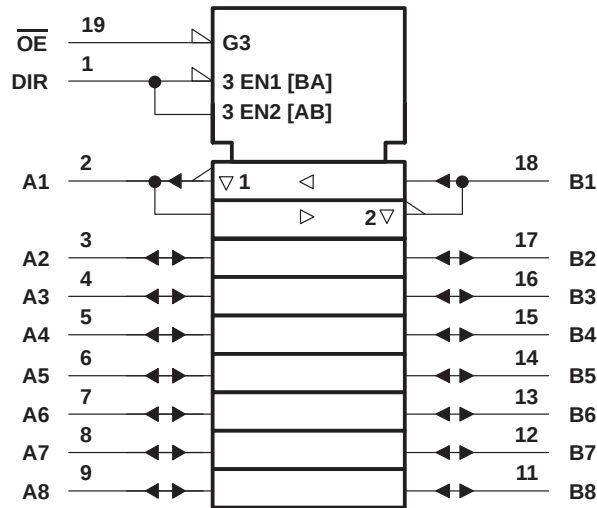
SN54ALS640B, SN54AS640, SN74ALS640B, SN74AS640

OCTAL BUS TRANSCEIVERS

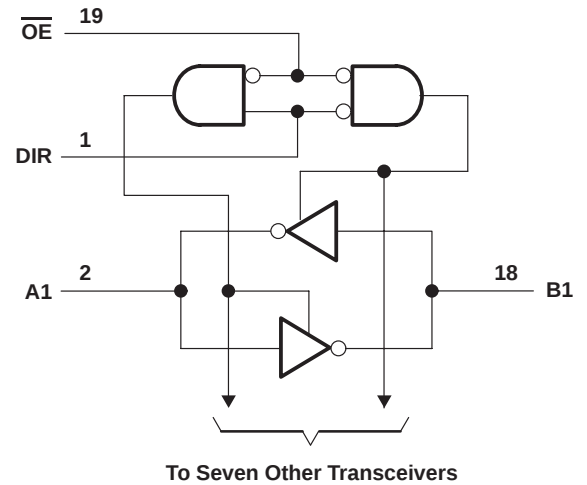
WITH 3-STATE OUTPUTS

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logic symbol†



logic diagram (positive logic)



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

Supply voltage, V_{CC}	7 V
Input voltage, V_I : All inputs	7 V
I/O ports	5.5 V
Operating free-air temperature range, T_A : SN54ALS640B	–55°C to 125°C
SN74ALS640B	0°C to 70°C
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.

recommended operating conditions

		SN54ALS640B			SN74ALS640B			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			0.7			0.8	V
I_{OH}	High-level output current			–12			–15	mA
I_{OL}	Low-level output current			12			24	mA
							48§	
T_A	Operating free-air temperature	–55		125	0		70	°C

§ Applies only to the -1 version and only if V_{CC} is between 4.75 V and 5.25 V

SN54ALS640B, SN54AS640, SN74ALS640B, SN74AS640
OCTAL BUS TRANSCEIVERS
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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		SN54ALS640B		SN74ALS640B		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 _{CC} = 4.5 V	I _{OH} = −3 mA	2.4	3.2	2.4	3.2	
			I _{OH} = −12 mA	2				
			I _{OH} = −15 mA			2		
V _{OL}		V _{CC} = 4.5 V	I _{OL} = 12 mA	0.25	0.4	0.25	0.4	V
			I _{OL} = 24 mA			0.35	0.5	
			I _{OL} = 48 mA‡			0.35	0.5	
I _I	Control inputs	V _{CC} = 5.5 V	V _I = 7 V	0.1		0.1		mA
	A or B ports		V _I = 5.5 V	0.1		0.1		
I _{IH}	Control inputs	V _{CC} = 5.5 V, V _I = 2.7 V	20		20		μA	
	A or B ports§		20		20			
I _{IL}	Control inputs	V _{CC} = 5.5 V, V _I = 0.4 V	−0.1		−0.1		mA	
	A or B ports§		−0.1		−0.1			
I _O ¶		V _{CC} = 5.5 V, V _O = 2.25 V	−20	−112	−30	−112	mA	
I _{CC}		V _{CC} = 5.5 V	Outputs high	19	50	19	45	mA
			Outputs low	27	60	27	55	
			Outputs disabled	28	55	28	50	

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

[‡] Applies only to the -1 version and only if V_{CC} is between 4.75 V and 5.25 V

[§] For I/O ports, the parameters I_{IH} and I_{IL} include the off-state output current.

^{||} 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)	VCC = 4.5 V to 5.5 V, CL = 50 pF, R1 = 500 Ω, R2 = 500 Ω, TA = MIN to MAX#				UNIT
			SN54ALS640B		SN74ALS640B		
			MIN	MAX	MIN	MAX	
tPLH	A or B	B or A	2	14	2	11	ns
tPHL			2	13	2	10	
tPZH	OE	A or B	4	25	4	21	ns
tPZL			5	27	5	24	
tPHZ	OE	A or B	2	12	2	10	ns
tPLZ			3	20	3	15	

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

SN54ALS640B, SN54AS640, SN74ALS640B, SN74AS640

OCTAL BUS TRANSCEIVERS

WITH 3-STATE OUTPUTS

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

Supply voltage, V_{CC}	7 V
Input voltage, V_I : All inputs	7 V
I/O ports	5.5 V
Operating free-air temperature range, T_A : SN54AS640	–55°C to 125°C
SN74AS640	0°C to 70°C
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.

recommended operating conditions

		SN54AS640			SN74AS640			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			–12			–15	mA
I_{OL}	Low-level output current			48			64	mA
T_A	Operating free-air temperature	–55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS		SN54AS640			SN74AS640			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, I _{OH} = −2 mA		V _{CC} − 2						V	
		V _{CC} = 4.5 V to 5.5 V, I _{OH} = −2 mA					V _{CC} − 2				
		V _{CC} = 4.5 V	I _{OH} = −3 mA	2.4	3.2		2.4	3.2			
			I _{OH} = −12 mA	2.4							
			I _{OH} = −15 mA				2.4				
V _{OL}		V _{CC} = 4.5 V		I _{OL} = 48 mA		0.3	0.55				V
				I _{OL} = 64 mA					0.35	0.55	
I _I	Control inputs	V _{CC} = 5.5 V		V _I = 7 V		0.1		0.1		mA	
	A or B ports			V _I = 5.5 V		0.1		0.1			
I _{IH}	Control inputs	V _{CC} = 5.5 V, V _I = 2.7 V		20		20				μA	
	A or B ports [§]			70		70					
I _{IL}	Control inputs	V _{CC} = 5.5 V, V _I = 0.4 V		−0.5		−0.5				mA	
	A or B ports [§]			−0.75		−0.75					
I _O		V _{CC} = 5.5 V, V _O = 2.25 V		−50		−150		−50		−150	mA
I _{CC}		V _{CC} = 5.5 V		Outputs high		37	58	37		58	mA
				Outputs low		78	123	78		123	
				Outputs disabled		51	80	51		80	

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

[§] For I/O ports, the parameters I_{IH} and I_{IL} include the off-state output current.

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



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switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX†				UNIT
			SN54AS640		SN74AS640		
			MIN	MAX	MIN	MAX	
t _{PLH}	A or B	B or A	1	8	2	7	ns
t _{PHL}			1	7	2	6	
t _{PZH}	$\overline{OE}$	A or B	2	10	2	8	ns
t _{PZL}			2	12	2	10	
t _{PHZ}	$\overline{OE}$	A or B	2	9	2	8	ns
t _{PLZ}			2	16	2	13	

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

SN54ALS640B, SN54AS640, SN74ALS640B, SN74AS640

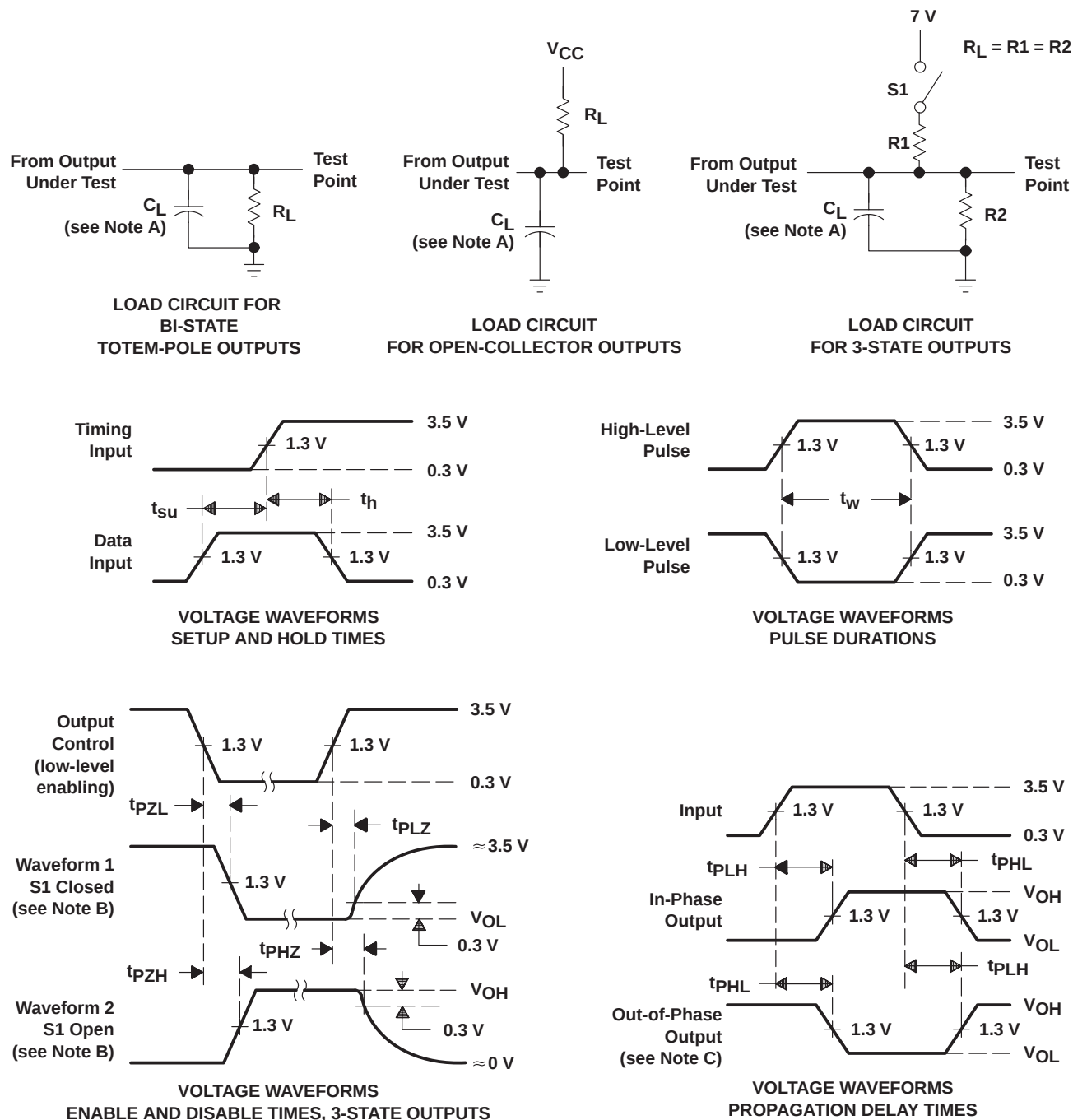
OCTAL BUS TRANSCEIVERS

WITH 3-STATE OUTPUTS

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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 part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
5962-8872701RA	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8872701RA SNJ54ALS640BJ
5962-8955301RA	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8955301RA SNJ54AS640J
SN54ALS640BJ	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54ALS640BJ
SN54ALS640BJ.A	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54ALS640BJ
SN74ALS640B-1DW	Obsolete	Production	SOIC (DW) 20	-	-	Call TI	Call TI	0 to 70	ALS640B-1
SN74ALS640B-1DWR	Active	Production	SOIC (DW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS640B-1
SN74ALS640B-1DWR.A	Active	Production	SOIC (DW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS640B-1
SN74ALS640B-1N	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74ALS640B-1N
SN74ALS640B-1N.A	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74ALS640B-1N
SN74ALS640B-1NSR	Active	Production	SOP (NS) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS640B-1
SN74ALS640B-1NSR.A	Active	Production	SOP (NS) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS640B-1
SN74ALS640BDW	Obsolete	Production	SOIC (DW) 20	-	-	Call TI	Call TI	0 to 70	ALS640B
SN74ALS640BDWR	Active	Production	SOIC (DW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS640B
SN74ALS640BDWR.A	Active	Production	SOIC (DW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS640B
SN74ALS640BN	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74ALS640BN
SN74ALS640BN.A	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74ALS640BN
SN74ALS640BNSR	Active	Production	SOP (NS) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS640B
SN74ALS640BNSR.A	Active	Production	SOP (NS) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS640B
SN74AS640N	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74AS640N
SN74AS640N.A	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74AS640N
SNJ54ALS640BJ	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8872701RA SNJ54ALS640BJ
SNJ54ALS640BJ.A	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8872701RA SNJ54ALS640BJ
SNJ54AS640J	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8955301RA SNJ54AS640J
SNJ54AS640J.A	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8955301RA SNJ54AS640J

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts 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.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN54ALS640B, SN54AS640, SN74ALS640B, SN74AS640 :

- Catalog : [SN74ALS640B](#), [SN74AS640](#)
- Military : [SN54ALS640B](#), [SN54AS640](#)

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

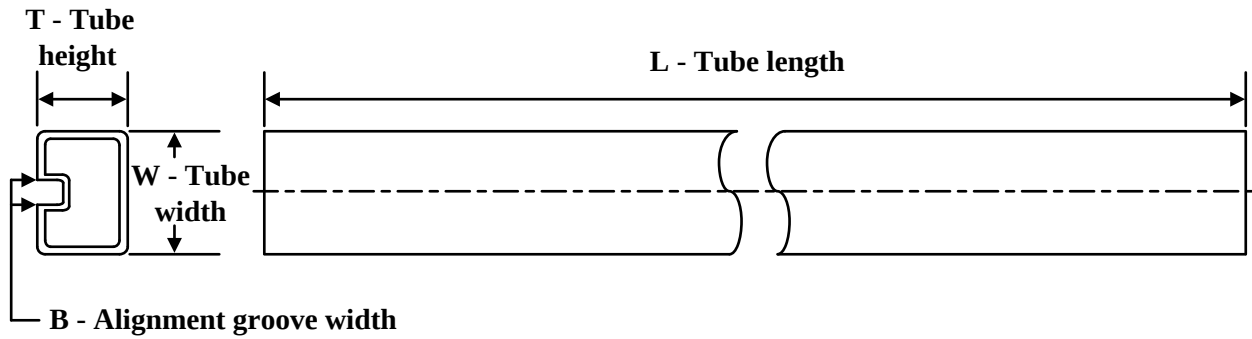
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74ALS640B-1DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74ALS640B-1NSR	SOP	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74ALS640BDWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74ALS640BNSR	SOP	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALS640B-1DWR	SOIC	DW	20	2000	356.0	356.0	45.0
SN74ALS640B-1NSR	SOP	NS	20	2000	356.0	356.0	45.0
SN74ALS640BDWR	SOIC	DW	20	2000	356.0	356.0	45.0
SN74ALS640BNSR	SOP	NS	20	2000	356.0	356.0	45.0

TUBE


*All dimensions are nominal

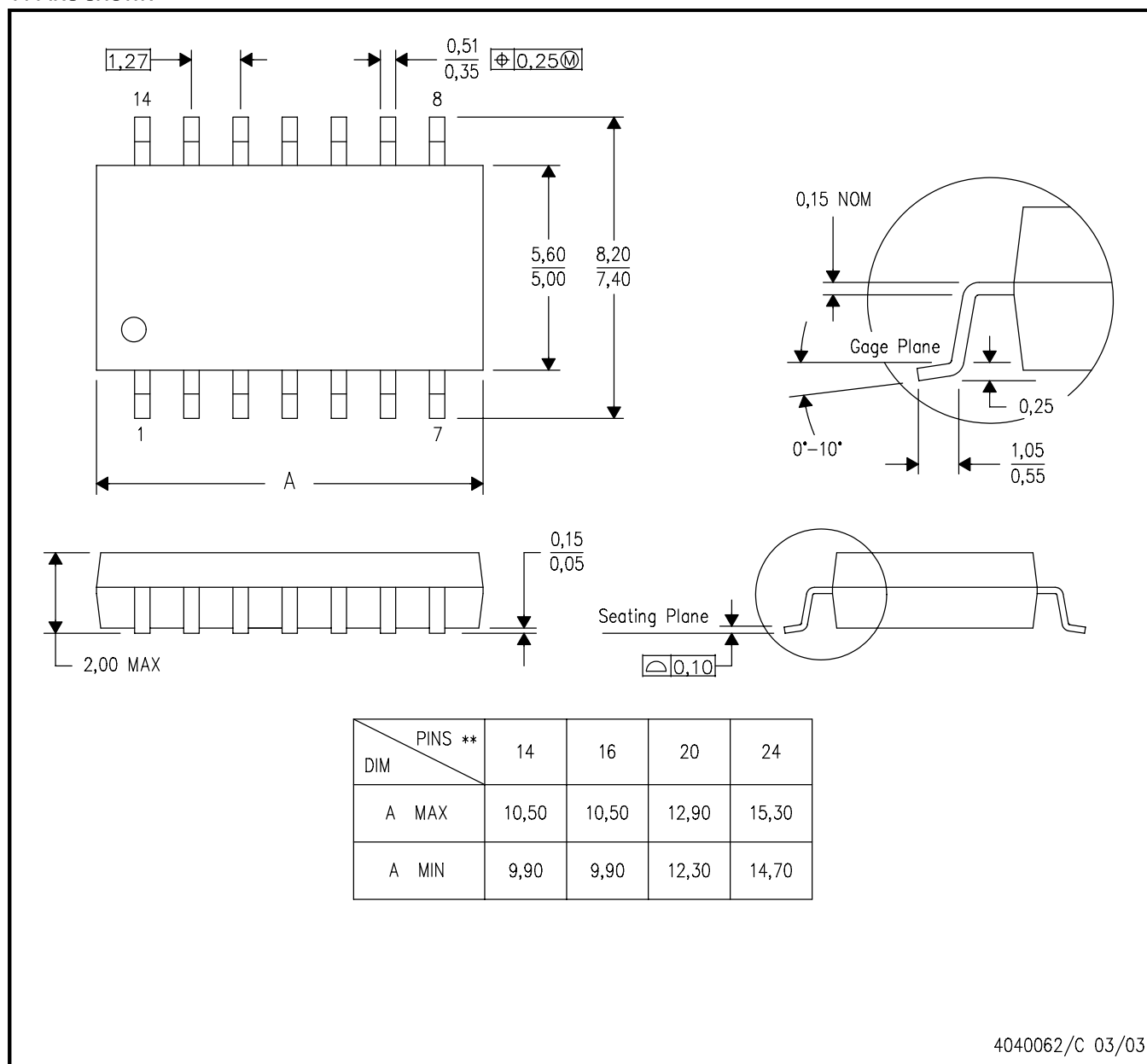
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74ALS640B-1N	N	PDIP	20	20	506	13.97	11230	4.32
SN74ALS640B-1N.A	N	PDIP	20	20	506	13.97	11230	4.32
SN74ALS640BN	N	PDIP	20	20	506	13.97	11230	4.32
SN74ALS640BN.A	N	PDIP	20	20	506	13.97	11230	4.32
SN74AS640N	N	PDIP	20	20	506	13.97	11230	4.32
SN74AS640N.A	N	PDIP	20	20	506	13.97	11230	4.32

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

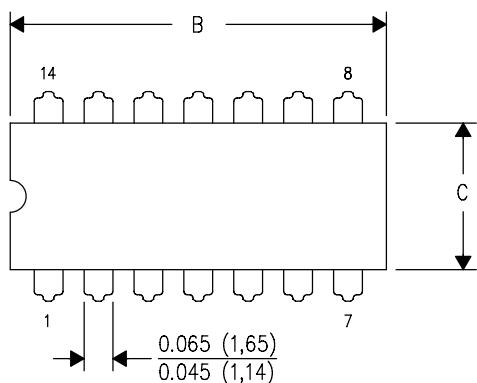


- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

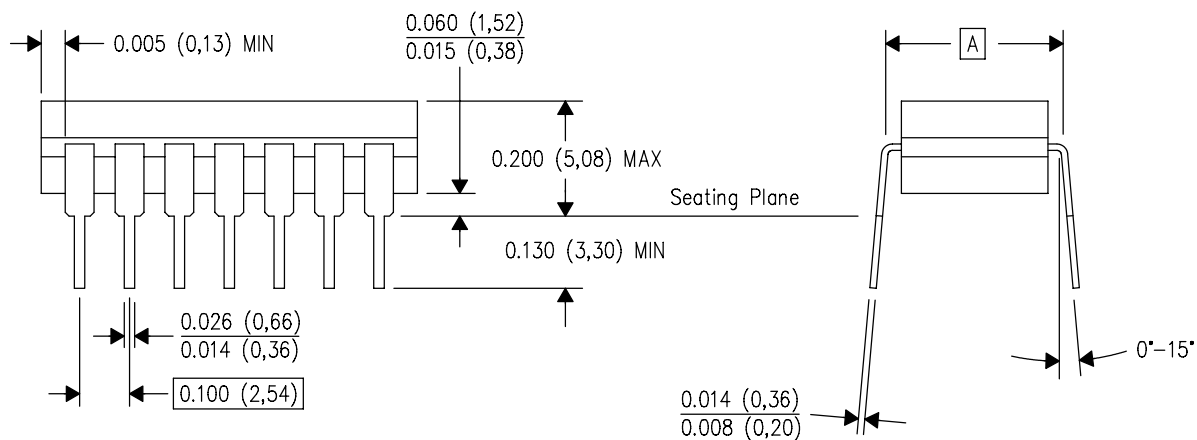
J (R-GDIP-T**)

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)



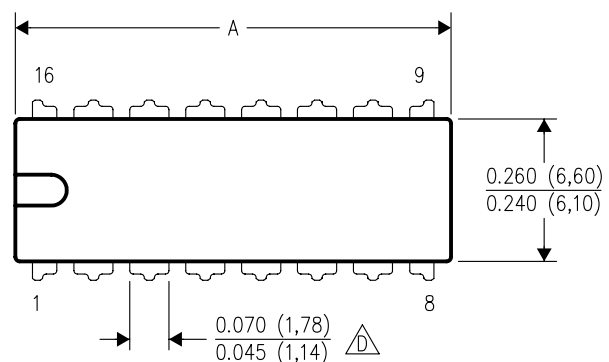
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- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal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

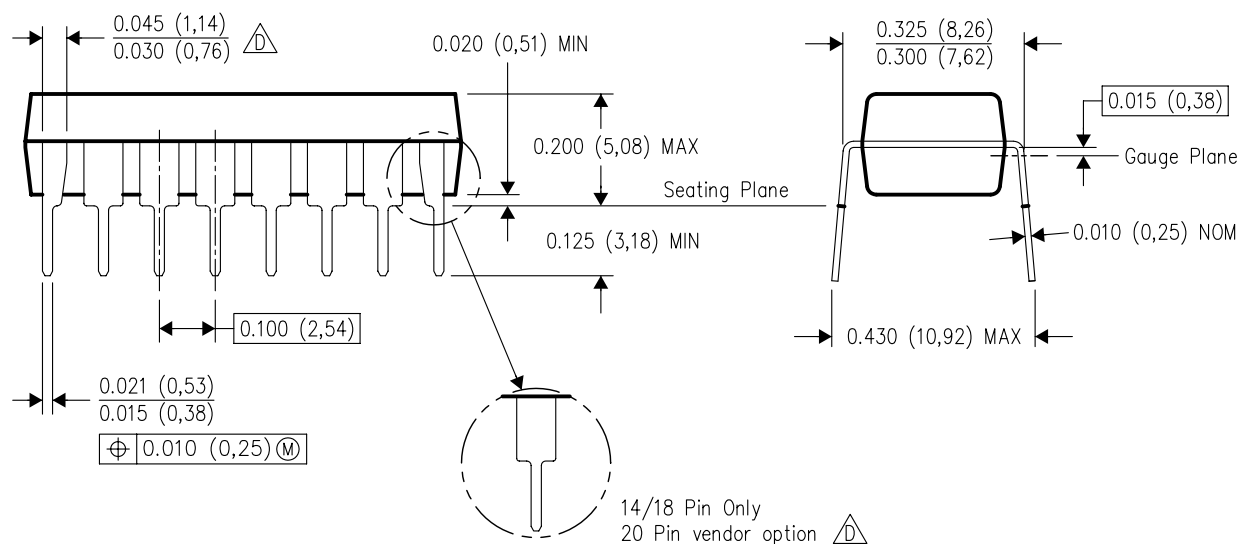
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE

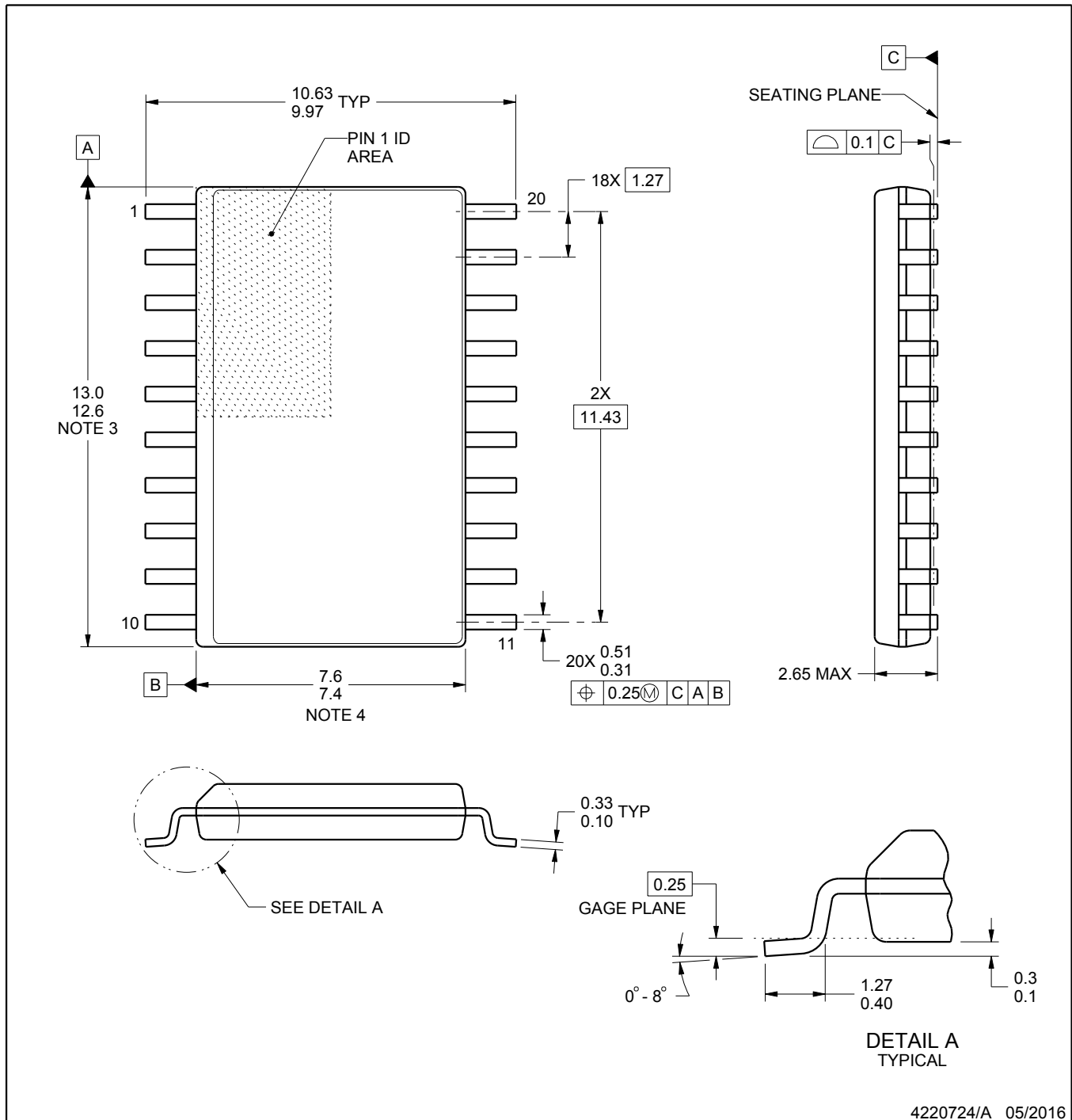
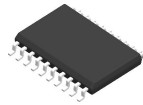


PINS **	14	16	18	20
DIM				
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



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.



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NOTES:

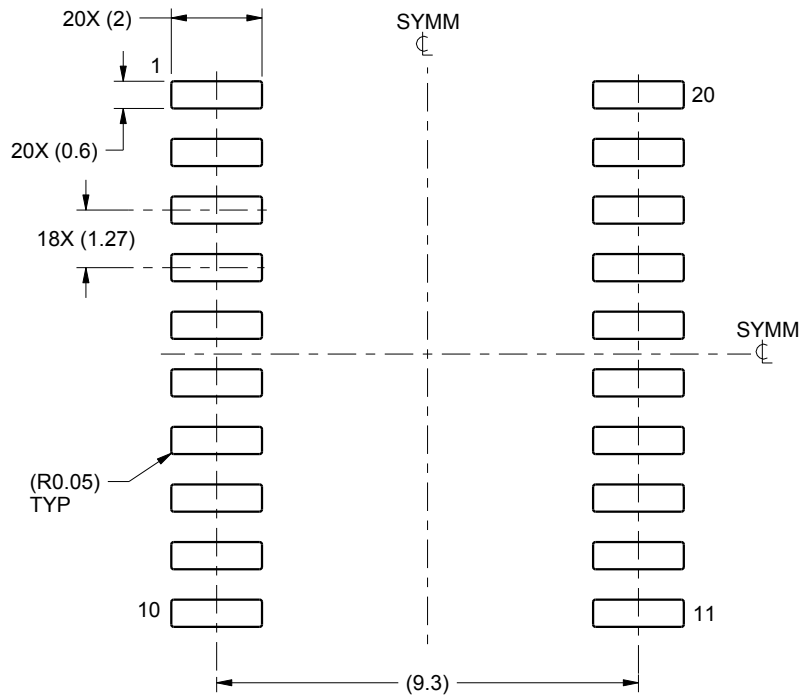
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.

EXAMPLE BOARD LAYOUT

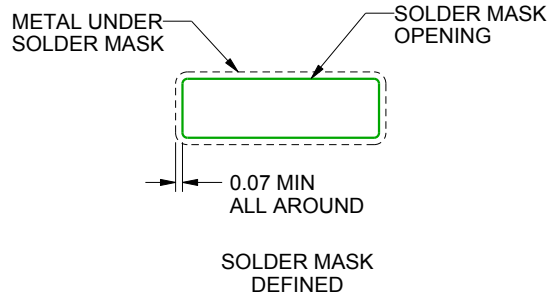
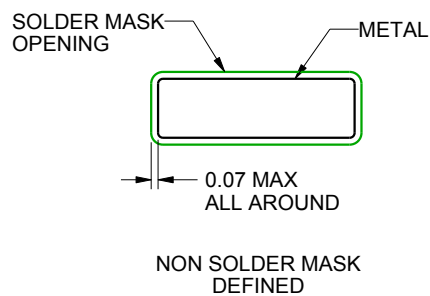
DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

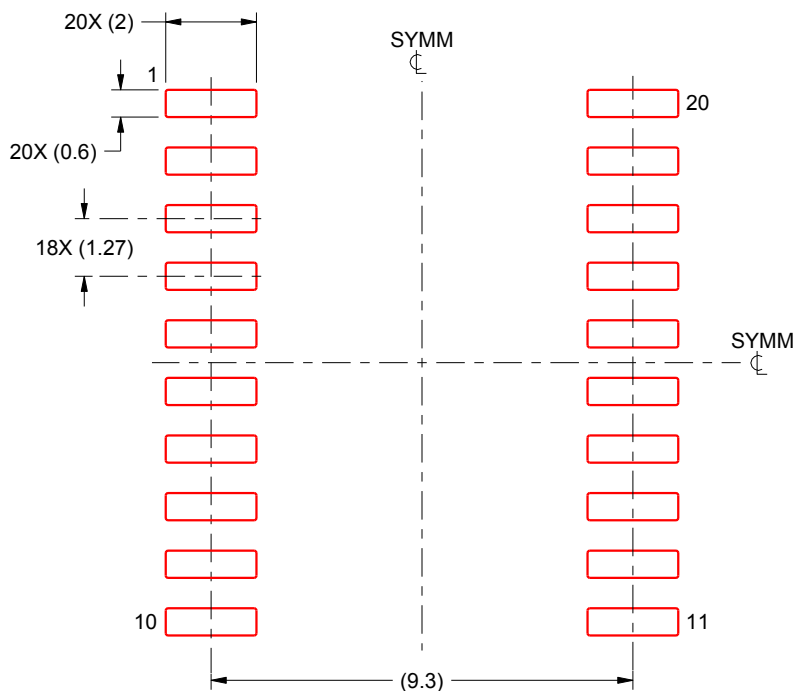
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

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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.

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