

SN54ABT533, SN74ABT533A OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

SCBS186D – JANUARY 1991 – REVISED JANUARY 1997

- State-of-the-Art **EPIC-IIIB™** BiCMOS Design Significantly Reduces Power Dissipation
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Typical V_{OLP} (Output Ground Bounce) < 1 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$
- High-Drive Outputs (-32 -mA I_{OH} , 64 -mA I_{OL})
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model ($C = 200$ pF, $R = 0$)
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages, Ceramic Chip Carriers (FK), Plastic (N) and Ceramic (J) DIPs, and Ceramic Flat (W) Package

description

These octal transparent D-type latches with 3-state outputs are designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

When the latch-enable (LE) input is high, the \bar{Q} outputs follow the complements of the data (D) inputs. When LE is taken low, the \bar{Q} outputs are latched at the inverse of the levels at the D inputs.

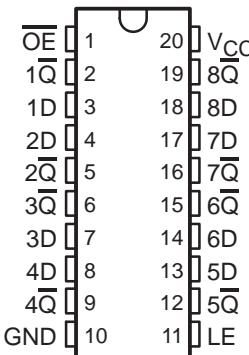
A buffered output-enable (\bar{OE}) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or a high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without need for interface or pullup components.

\bar{OE} does not affect the internal operations of the latches. Previously stored data can be retained or new data can be entered while the outputs are in the high-impedance state.

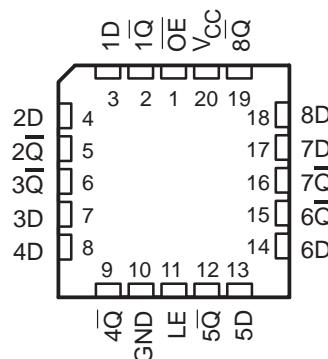
To ensure the high-impedance state during power up or power down, \bar{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The SN54ABT533 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABT533A is characterized for operation from -40°C to 85°C .

SN54ABT533 . . . J OR W PACKAGE
SN74ABT533A . . . DB, DW, N, OR PW PACKAGE
(TOP VIEW)



SN54ABT533 . . . FK PACKAGE
(TOP VIEW)



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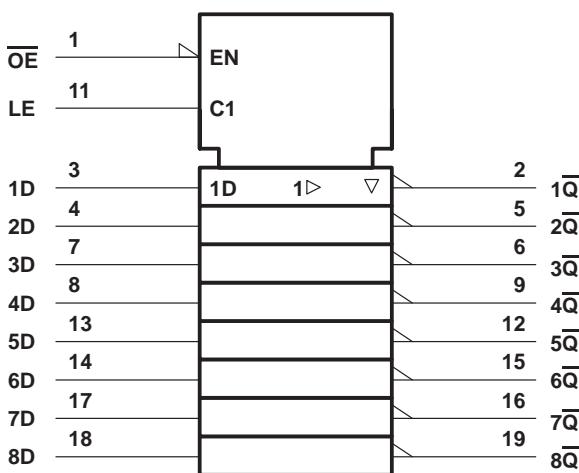
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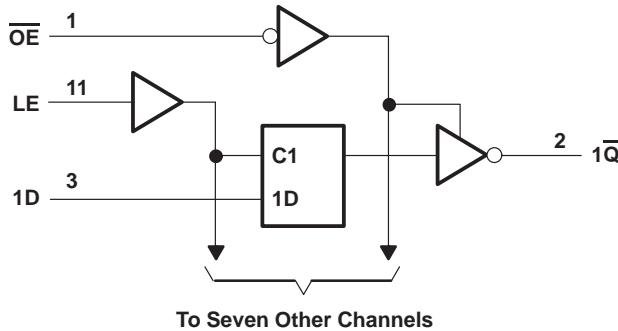
FUNCTION TABLE (each latch)

INPUTS			OUTPUT
OE	LE	D	Q
L	H	H	L
L	H	L	H
L	L	X	\overline{Q}_0
H	X	X	Z

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)‡

‡ 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 negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
 2. The package thermal impedance is calculated in accordance with EIA/JEDEC Std JESD51, except for through-hole packages, which use a trace length of zero.

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recommended operating conditions (see Note 3)

		SN54ABT533		SN74ABT533A		UNIT
		MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage	4.5	5.5	4.5	5.5	V
V _{IH}	High-level input voltage	2		2		V
V _{IL}	Low-level input voltage		0.8		0.8	V
V _I	Input voltage	0	V _{CC}	0	V _{CC}	V
I _{OH}	High-level output current		-24		-32	mA
I _{OL}	Low-level output current		48		64	mA
Δt/Δv	Input transition rise or fall rate		10		10	ns/V
T _A	Operating free-air temperature	-55	125	-40	85	°C

NOTE 3: Unused inputs must be held high or low to prevent them from floating.

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

PARAMETER	TEST CONDITIONS	T _A = 25°C			SN54ABT533	SN74ABT533A	UNIT
		MIN	TYP†	MAX	MIN	MAX	
V _{IK}	V _{CC} = 4.5 V, I _I = -18 mA			-1.2	-1.2	-1.2	V
V _{OH}	V _{CC} = 4.5 V, I _{OH} = -3 mA		2.5		2.5	2.5	V
	V _{CC} = 5 V, I _{OH} = -3 mA		3		3	3	
	V _{CC} = 4.5 V I _{OH} = -24 mA		2		2		
V _{OL}	V _{CC} = 4.5 V I _{OL} = 48 mA			2*		2	V
					0.55		
	I _{OL} = 64 mA				0.55*		
V _{hys}			100				mV
I _I	V _{CC} = 5.5 V, V _I = V _{CC} or GND		±1		±1	±1	µA
I _{OZH}	V _{CC} = 5.5 V, V _O = 2.7 V			10	10	10	µA
I _{OZL}	V _{CC} = 5.5 V, V _O = 0.5 V			-10	-10	-10	µA
I _{off}	V _{CC} = 0, V _I or V _O ≤ 4.5 V			±150		±150	µA
I _{CEX}	V _{CC} = 5.5 V, V _O = 5.5 V	Outputs high		50	50	50	µA
I _{O‡}	V _{CC} = 5.5 V, V _O = 2.5 V		-50	-140	-180	-50	mA
I _{CC}	V _{CC} = 5.5 V, I _O = 0, V _I = V _{CC} or GND	Outputs high		1	250	250	µA
		Outputs low		24	30	30	mA
		Outputs disabled		0.5	250	250	µA
ΔI _{CC} §	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND	Outputs high		1.5	1.5	1.5	mA
		Outputs low		1.5	1.5	1.5	
		Outputs disabled		1.5	1.5	1.5	
C _i	V _I = 2.5 V or 0.5 V			3.5			pF
C _o	V _O = 2.5 V or 0.5 V			6.5			pF

* On products compliant to MIL-PRF-38535, this parameter does not apply.

† All typical values are at V_{CC} = 5 V.

‡ Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

§ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

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timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

			SN54ABT533		UNIT	
			V _{CC} = 5 V, T _A = 25°C			
			MIN	MAX		
t _W	Pulse duration, LE high		3.3	3.3	ns	
t _{SU}	Setup time, data before LE↓	High or low	2.1	2.1	ns	
t _H	Hold time, data after LE↓	High or low	1.5	1.5	ns	

timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

			SN74ABT533A		UNIT	
			V _{CC} = 5 V, T _A = 25°C			
			MIN	MAX		
t _W	Pulse duration, LE high		3.3	3.3	ns	
t _{SU}	Setup time, data before LE↓	High or low	2.1	2.1	ns	
t _H	Hold time, data after LE↓	High or low	2.1	2.1	ns	

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ABT533			UNIT	
			V _{CC} = 5 V, T _A = 25°C		MIN		
			MIN	TYP	MAX		
t _{PLH}	D	Q	1.9	4.2	5.4	1.9	6.7
t _{PHL}			3.1	4.9	6.3	3.1	6.9
t _{PLH}	LE	Q	2.7	4.9	6.2	2.7	7.6
t _{PHL}			3.5	5.4	6.8	3.5	7.5
t _{PZH}	OE	Q	1.6	3.7	4.8	1.6	5.8
t _{PZL}			2.4	4.2	6.2	2.4	6.9
t _{PHZ}	OE	Q	2.8	5.1	6.2	2.8	7.2
t _{PLZ}			2	4.1	6	2	6.9

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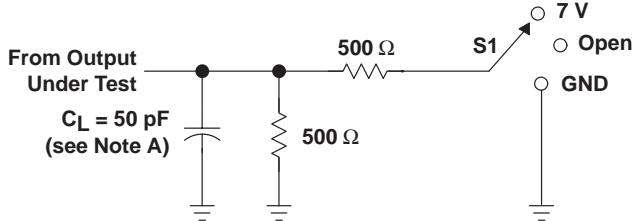
switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50 \text{ pF}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74ABT533A			UNIT	
			$V_{CC} = 5 \text{ V},$ $T_A = 25^\circ\text{C}$		MIN		
			MIN	TYP			
t_{PLH}	D	\bar{Q}	1.7	4.2	5.4	1.7	6.4
t_{PHL}			2.6	4.9	6.3	2.6	6.6
t_{PLH}	LE	\bar{Q}	2.7	4.9	6.2	2.7	7.3
t_{PHL}			3.5	5.4	6.8	3.5	7.3
t_{PZH}	\bar{OE}	\bar{Q}	1.6	3.7	4.8	1.6	5.7
t_{PZL}			2.4	4.2	6.2	2.4	6.7
t_{PHZ}	\bar{OE}	\bar{Q}	1.6	5.1	6.2	1.6	6.9
t_{PLZ}			2	4.1	6	2	6.5

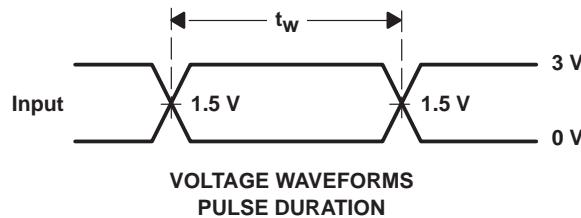
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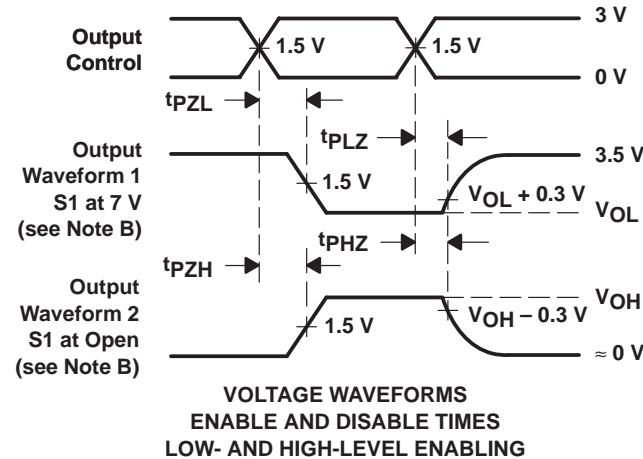
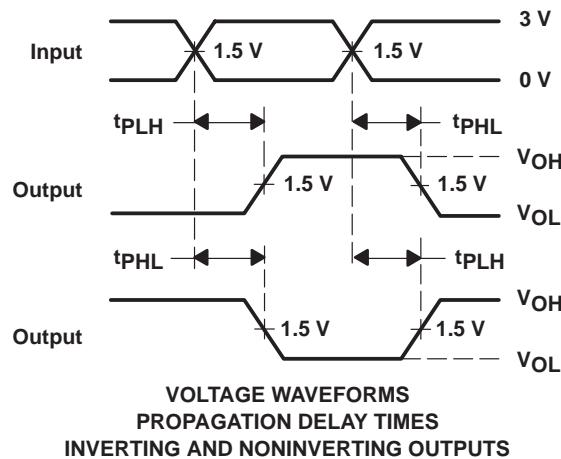
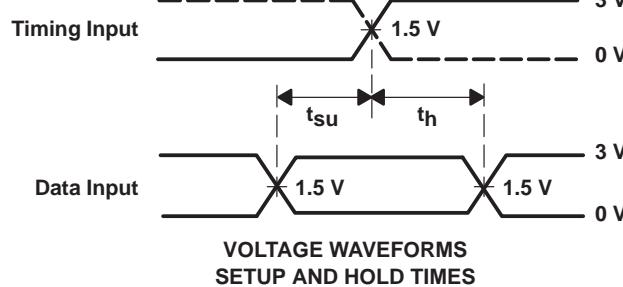
PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT



TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



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. All input pulses are supplied by generators having the following characteristics: PRR $\leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
 D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit 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)
5962-9584301Q2A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9584301Q2A SNJ54 ABT533FK
5962-9584301QRA	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9584301QR A SNJ54ABT533J
SN74ABT533AN	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	SN74ABT533AN
SN74ABT533AN.B	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	SN74ABT533AN
SN74ABT533APWR	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AB533A
SN74ABT533APWR.B	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AB533A
SNJ54ABT533FK	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9584301Q2A SNJ54 ABT533FK
SNJ54ABT533J	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9584301QR A SNJ54ABT533J

⁽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.

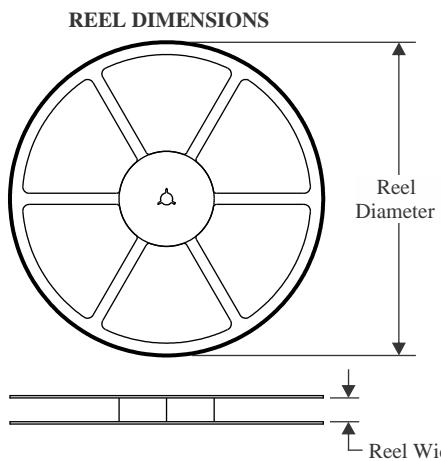
⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will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

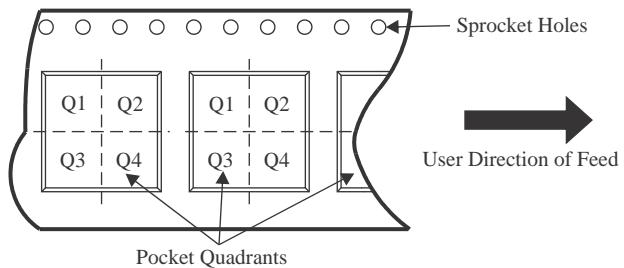
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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TAPE AND REEL INFORMATION


A0	Dimension designed to accommodate the component width
B0	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


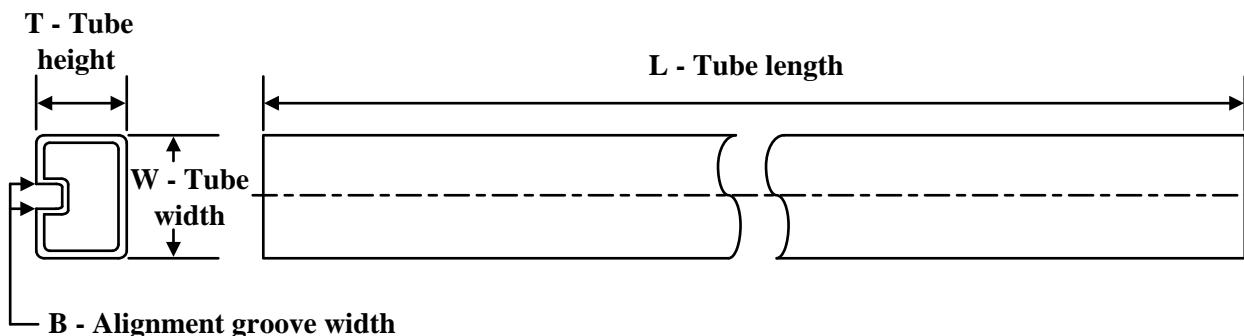
*All dimensions are nominal

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
SN74ABT533APWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	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)
SN74ABT533APWR	TSSOP	PW	20	2000	353.0	353.0	32.0

TUBE


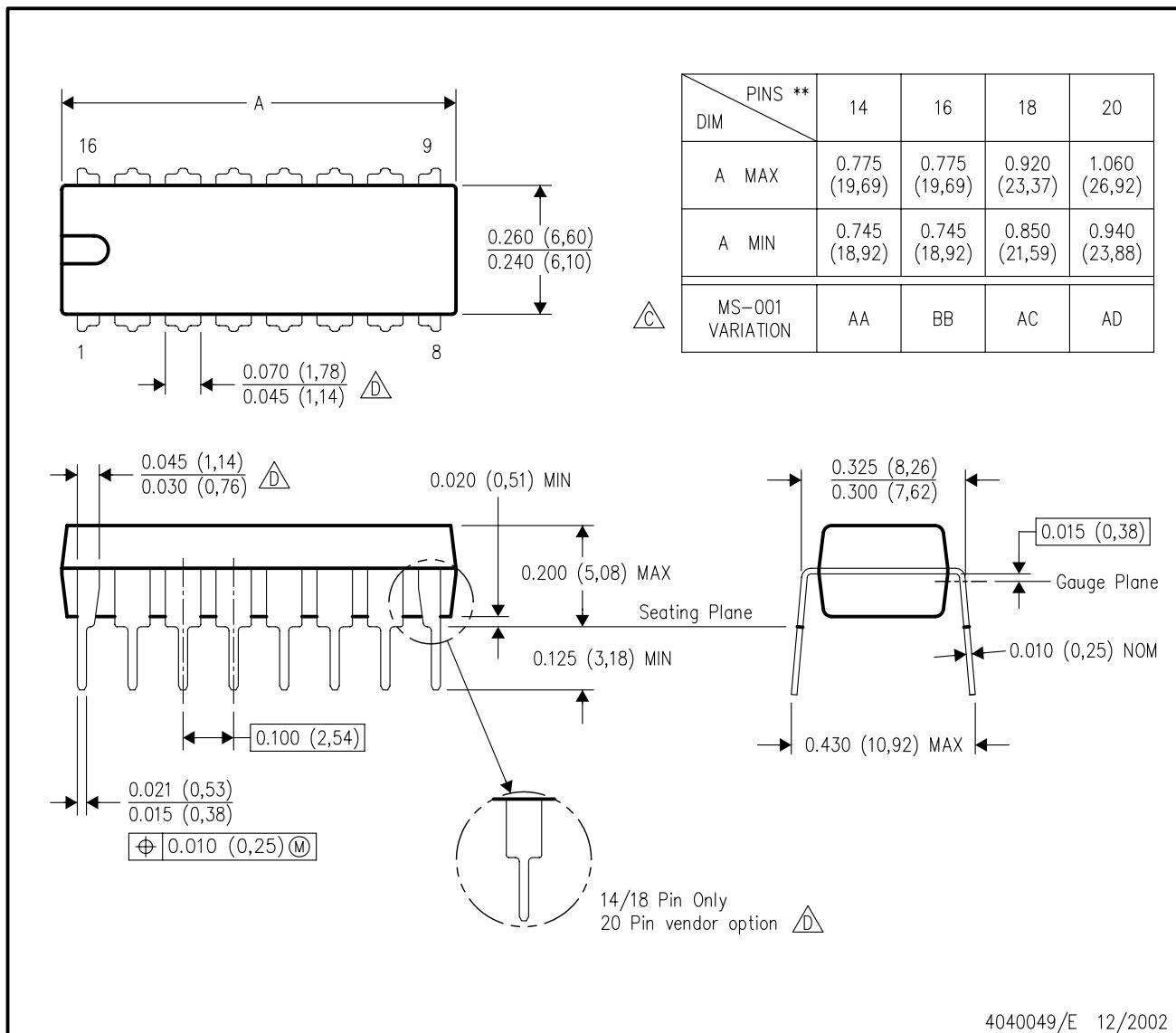
*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μ m)	B (mm)
5962-9584301Q2A	FK	LCCC	20	55	506.98	12.06	2030	NA
SN74ABT533AN	N	PDIP	20	20	506	13.97	11230	4.32
SN74ABT533AN.B	N	PDIP	20	20	506	13.97	11230	4.32
SNJ54ABT533FK	FK	LCCC	20	55	506.98	12.06	2030	NA

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



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.

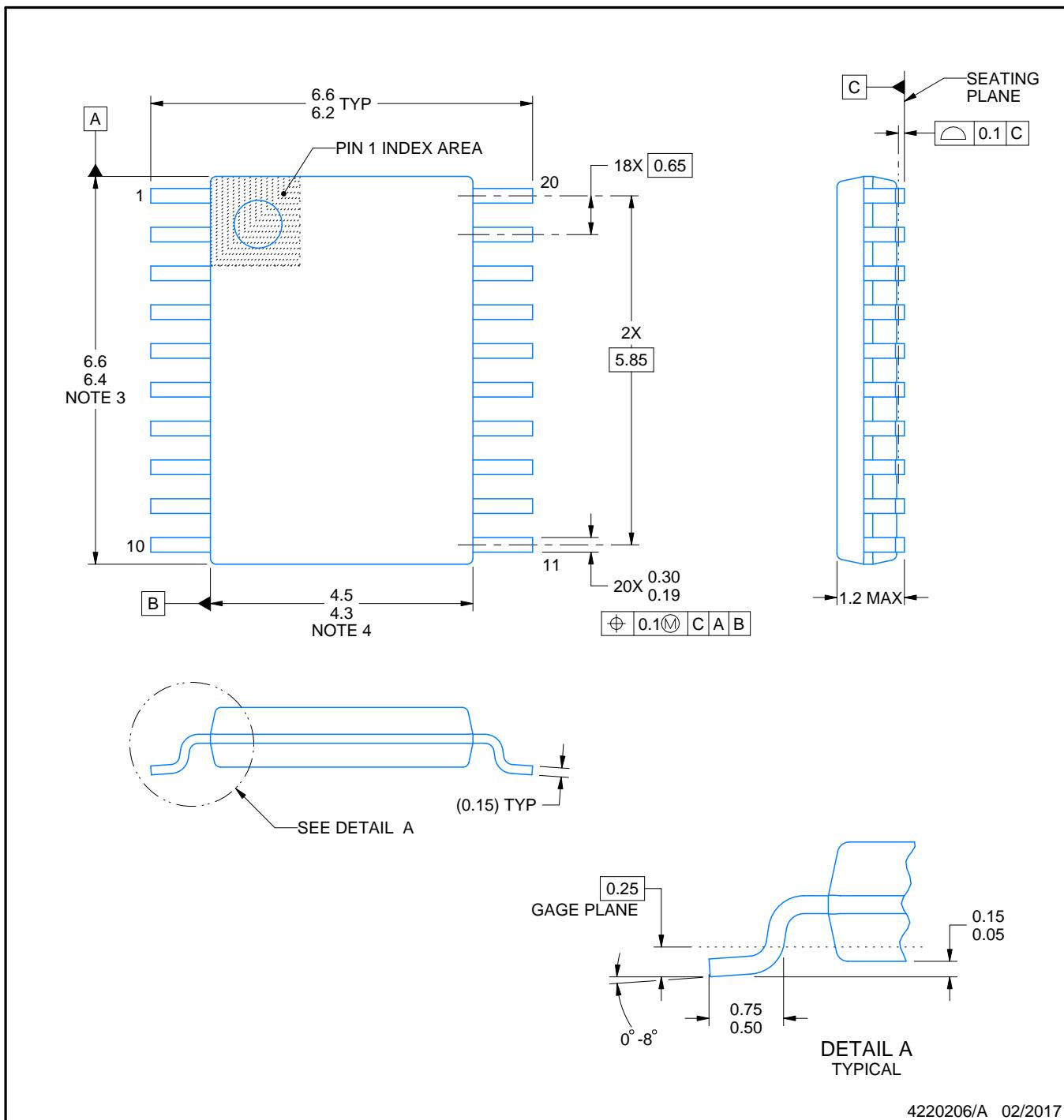
PACKAGE OUTLINE

PW0020A



TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

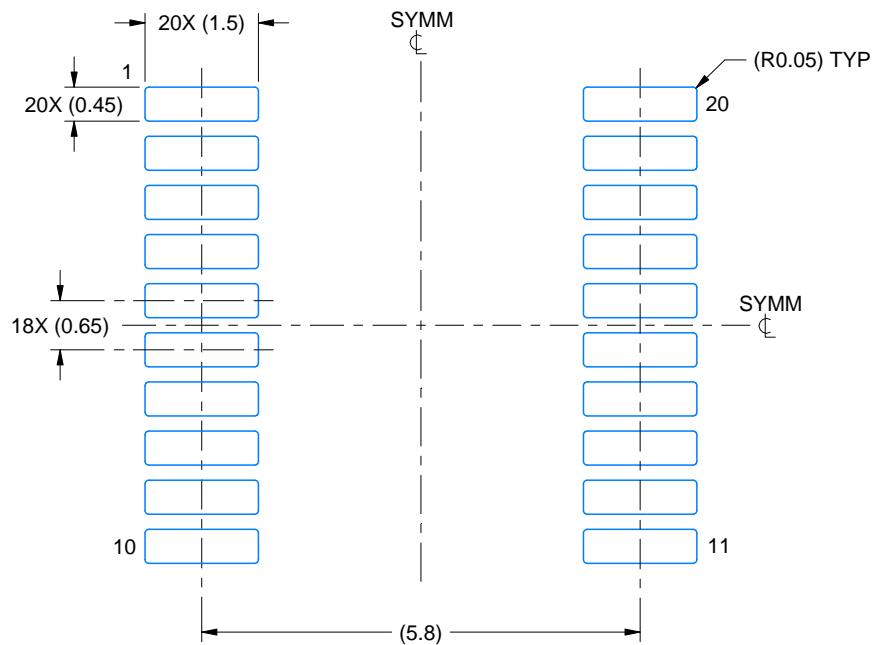
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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

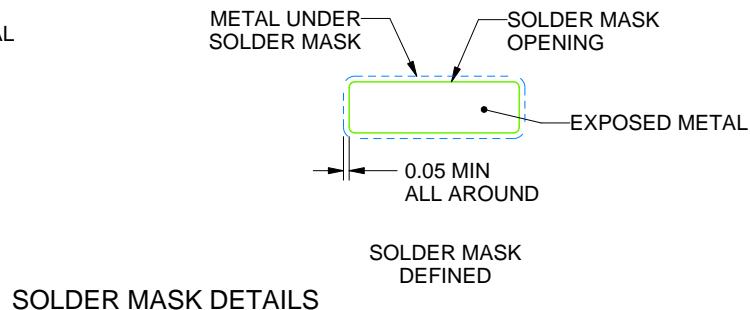
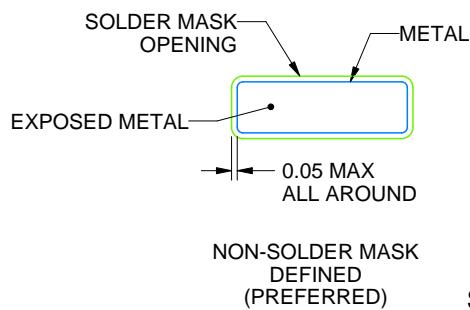
PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220206/A 02/2017

NOTES: (continued)

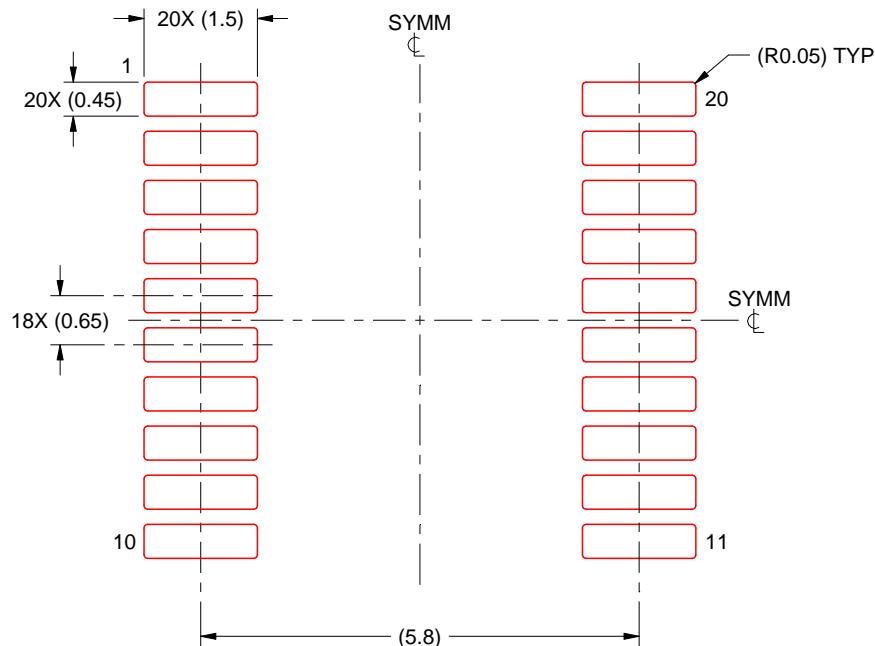
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

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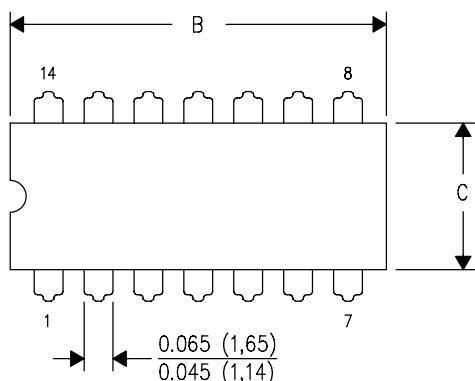
NOTES: (continued)

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.

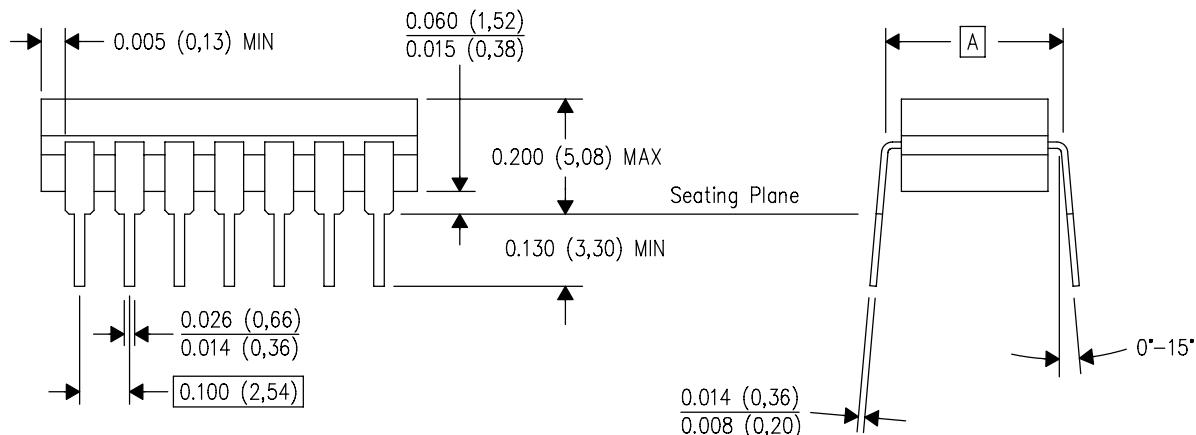
J (R-GDIP-T**)

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.

GENERIC PACKAGE VIEW

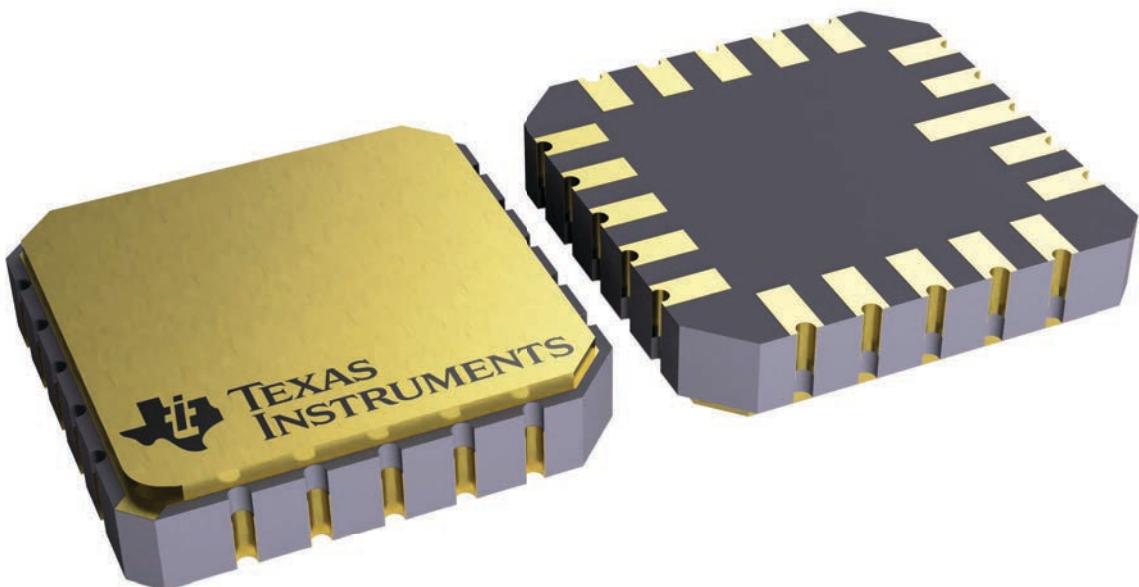
FK 20

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\

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