

SN54HC365, SN74HC365 HEX BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

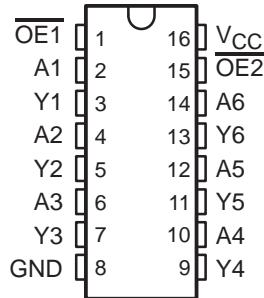
SCLS308D – JANUARY 1996 – REVISED OCTOBER 2003

- Wide Operating Voltage Range of 2 V to 6 V
- High-Current 3-State Outputs Drive Bus Lines, Buffer-Memory Address Registers, or Drive Up To 15 LSTTL Loads
- True Outputs
- Low Power Consumption, 80- μ A Max I_{CC}
- Typical $t_{pd} = 10$ ns
- ± 6 -mA Output Drive at 5 V
- Low Input Current of 1 μ A Max

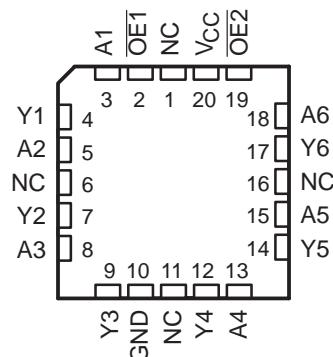
description/ordering information

These hex buffers and line drivers are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The 'HC365 devices contain six independent buffers/drivers with dual-gated output-enable (\overline{OE}_1 and \overline{OE}_2) inputs. When \overline{OE}_1 and \overline{OE}_2 are both low, the devices pass noninverted data from the A inputs to the Y outputs. If either (or both) output-enable terminal(s) is high, the outputs are in the high-impedance state.

SN54HC365 . . . J OR W PACKAGE
SN74HC365 . . . D, N, NS, OR PW PACKAGE
(TOP VIEW)



SN54HC365 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

ORDERING INFORMATION

TA	PACKAGE [†]		ORDERABLE PART NUMBER	TOP-SIDE MARKING	
–40°C to 85°C	PDIP – N	Tube of 25	SN74HC365N	SN74HC365N	
		Tube of 40	SN74HC365D	HC365	
		Reel of 2500	SN74HC365DR		
		Reel of 250	SN74HC365DT		
	SOIC – D	Reel of 2000	SN74HC365NSR	HC365	
		Reel of 90	SN74HC365PW	HC365	
		Reel of 2000	SN74HC365PWR		
	TSSOP – PW	Reel of 250	SN74HC365PWT		
		CDIP – J	SNJ54HC365J	SNJ54HC365J	
–55°C to 125°C		CFP – W	SNJ54HC365W	SNJ54HC365W	
		LCCC – FK	SNJ54HC365FK	SNJ54HC365FK	

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



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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.

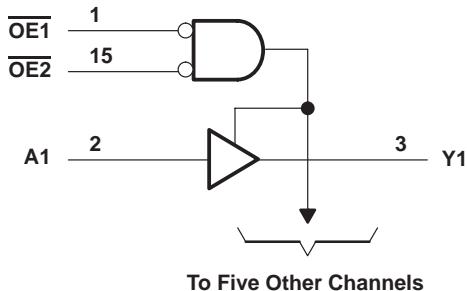
SN54HC365, SN74HC365 HEX BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

SCLS308D – JANUARY 1996 – REVISED OCTOBER 2003

FUNCTION TABLE (each buffer/driver)

INPUTS			OUTPUT
OE1	OE2	A	Y
H	X	X	Z
X	H	X	Z
L	L	H	H
L	L	L	L

logic diagram (positive logic)



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

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 voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JEDEC 51-7.

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SCLS308D – JANUARY 1996 – REVISED OCTOBER 2003

recommended operating conditions (see Note 3)

			SN54HC365			SN74HC365			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
Δt/ΔV	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	

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			SN54HC365		SN74HC365		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} = -6 mA	4.5 V	3.98	4.3	3.7		3.84			
			6 V	5.48	5.8	5.2		5.34			
		I _{OL} = 20 μA	2 V		0.002	0.1	0.1		0.1		
V _{OL}	V _I = V _{IH} or V _{IL}		4.5 V		0.001	0.1	0.1		0.1		
			6 V		0.001	0.1	0.1		0.1		
			I _{OL} = 6 mA	4.5 V		0.17	0.26	0.4	0.33		
			I _{OL} = 7.8 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 _{OZ}	V _O = V _{CC} or 0	6 V		±0.01	±0.5		±10		±5	μA	
I _{CC}	V _I = V _{CC} or 0, I _O = 0	6 V			8	160	160	80	80	μA	
C _i		2 V to 6 V		3	10	10	10	10	10	pF	

**SN54HC365, SN74HC365
HEX BUFFERS AND LINE DRIVERS
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SCLS308D – JANUARY 1996 – REVISED OCTOBER 2003

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	T _A = 25°C			SN54HC365	SN74HC365	UNIT
				MIN	TYP	MAX	MIN	MAX	
t _{pd}	A	Y	2 V	50	95	145	120	120	ns
			4.5 V	12	19	29	24	24	
			6 V	10	16	25	20	20	
t _{en}	OE	Y	2 V	100	190	285	238	238	ns
			4.5 V	26	38	57	48	48	
			6 V	21	32	48	41	41	
t _{dis}	OE	Y	2 V	50	175	265	240	240	ns
			4.5 V	21	35	53	48	48	
			6 V	19	30	45	41	41	
t _t		Any	2 V	28	60	90	75	75	ns
			4.5 V	8	12	18	15	15	
			6 V	6	10	15	13	13	

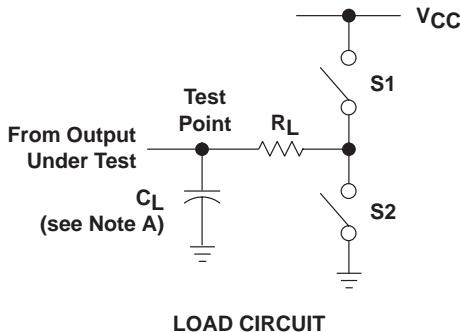
switching characteristics over recommended operating free-air temperature range, $C_L = 150 \text{ pF}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	T _A = 25°C			SN54HC365	SN74HC365	UNIT
				MIN	TYP	MAX	MIN	MAX	
t _{pd}	A	Y	2 V	70	120	180	150	150	ns
			4.5 V	17	24	36	30	30	
			6 V	14	20	31	25	25	
t _{en}	OE	Y	2 V	140	230	345	285	285	ns
			4.5 V	30	46	69	57	57	
			6 V	28	39	59	48	48	
t _t		Any	2 V	45	210	315	265	265	ns
			4.5 V	17	42	63	53	53	
			6 V	13	36	53	45	45	

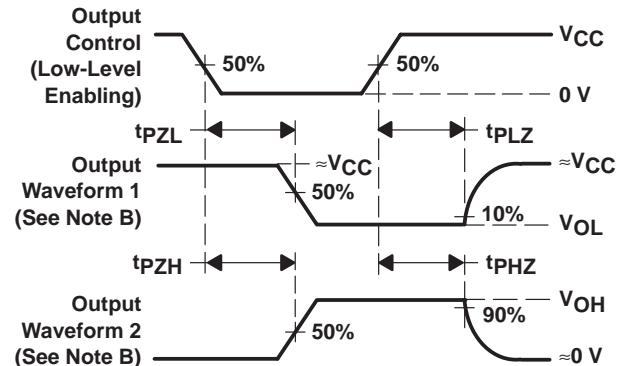
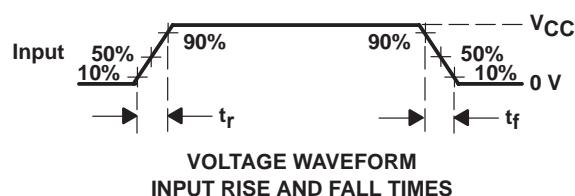
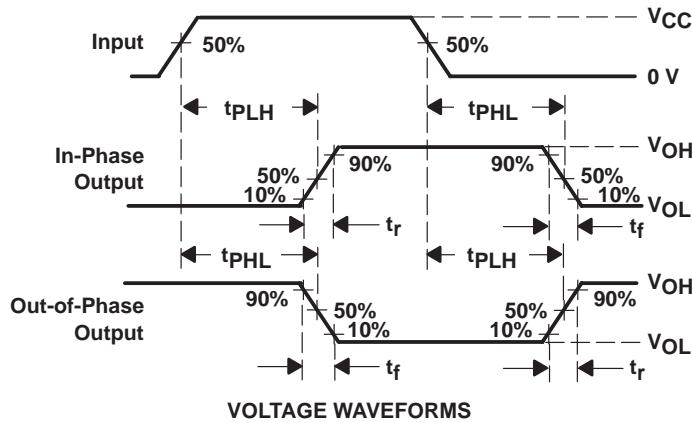
operating characteristics, T_A = 25°C

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

PARAMETER MEASUREMENT INFORMATION



PARAMETER	R_L	C_L	S1	S2
t_{en}	1 k Ω	50 pF	Open	Closed
		or 150 pF	Closed	Open
t_{dis}	1 k Ω	50 pF	Open	Closed
		or 150 pF	Closed	Open
t_{pd} or t_t	--	50 pF or 150 pF	Open	Open



NOTES:

- C_L includes probe and test-fixture capacitance.
- 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.
- Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR \leq 1 MHz, $Z_O = 50 \Omega$, $t_r = 6$ ns, $t_f = 6$ ns.
- The outputs are measured one at a time with one input transition per measurement.
- t_{PLH} and t_{PHL} are the same as t_{pd} .
- t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- t_{PZL} and t_{PZH} are the same as t_{en} .

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⁾
85001012A	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
8500101EA	ACTIVE	CDIP	J	16	1	None	Call TI	Level-NC-NC-NC
JM38510/65706BEA	ACTIVE	CDIP	J	16	1	None	Call TI	Level-NC-NC-NC
SN54HC365J	ACTIVE	CDIP	J	16	1	None	Call TI	Level-NC-NC-NC
SN74HC365D	ACTIVE	SOIC	D	16	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/Level-1-235C-UNLIM
SN74HC365DR	ACTIVE	SOIC	D	16	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/Level-1-235C-UNLIM
SN74HC365DT	ACTIVE	SOIC	D	16	250	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/Level-1-235C-UNLIM
SN74HC365N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74HC365NSR	ACTIVE	SO	NS	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/Level-1-235C-UNLIM
SN74HC365PW	ACTIVE	TSSOP	PW	16	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74HC365PWR	ACTIVE	TSSOP	PW	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74HC365PWT	ACTIVE	TSSOP	PW	16	250	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SNJ54HC365FK	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
SNJ54HC365J	ACTIVE	CDIP	J	16	1	None	Call TI	Level-NC-NC-NC

⁽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 - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

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.

Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

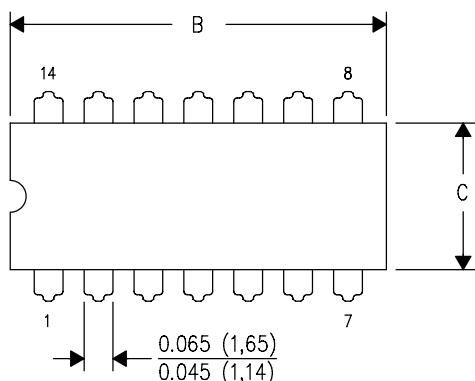
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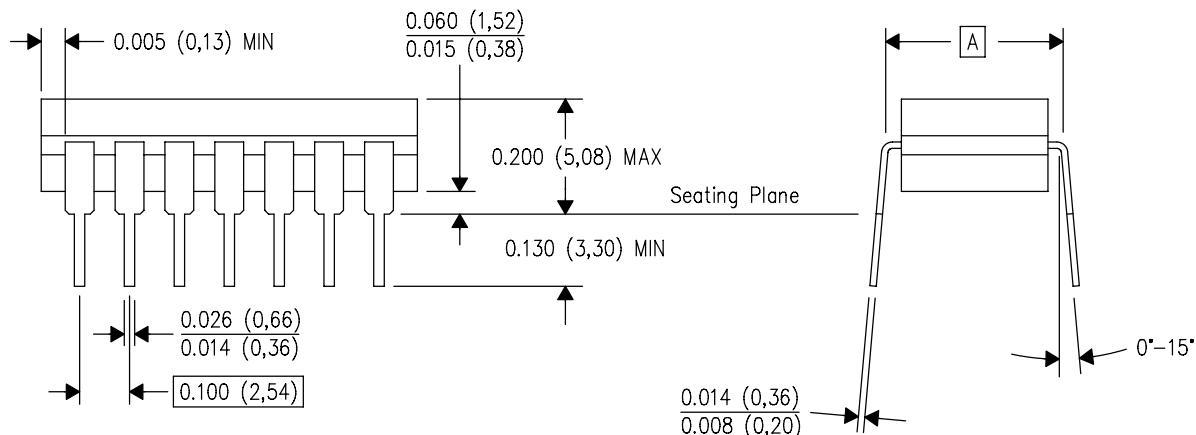
J (R-GDIP-T**)

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)



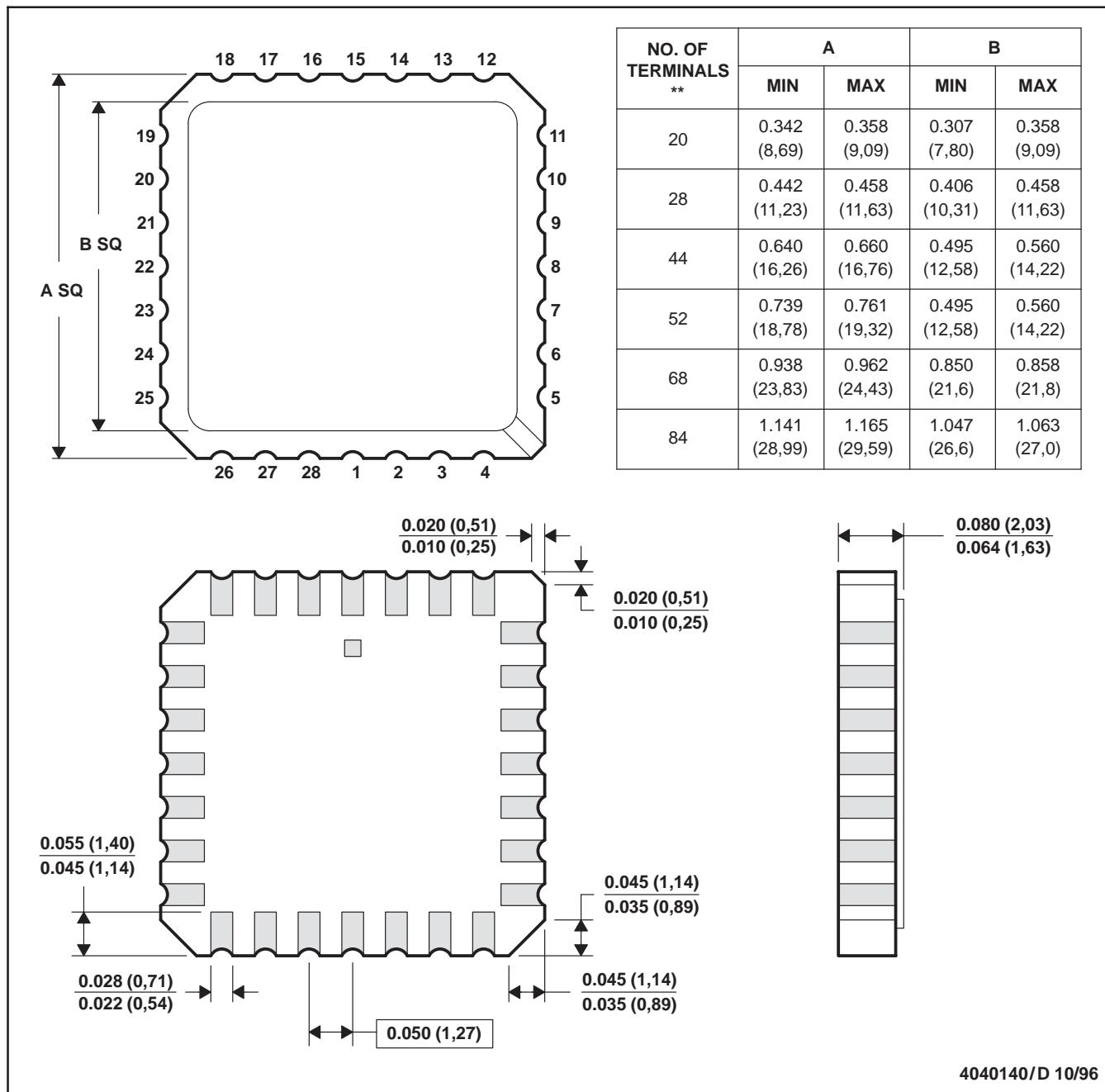
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NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification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

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



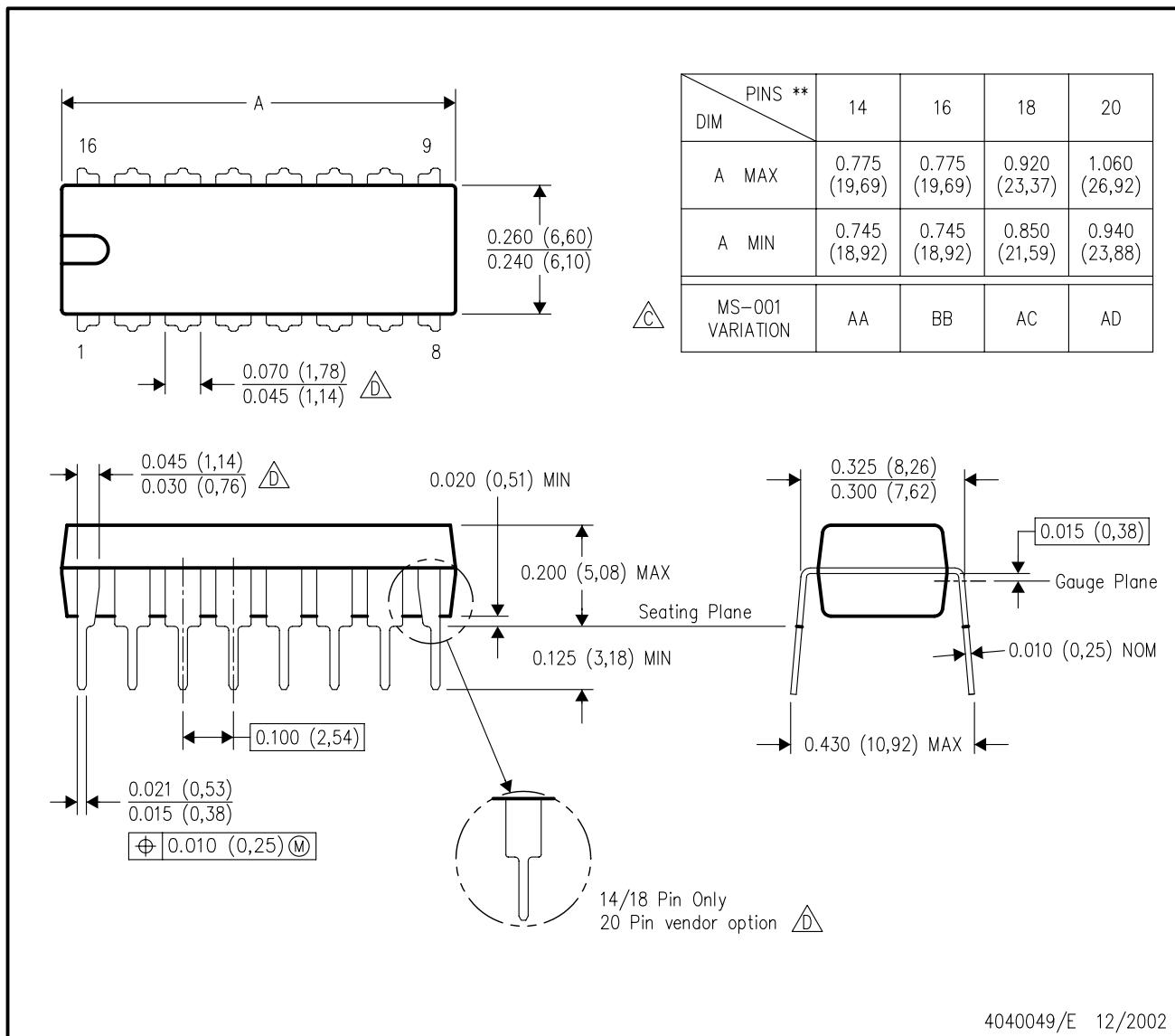
NOTES:

- 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 metal lid.
- D. The terminals are gold plated.
- E. Falls within JEDEC MS-004

N (R-PDIP-T**)

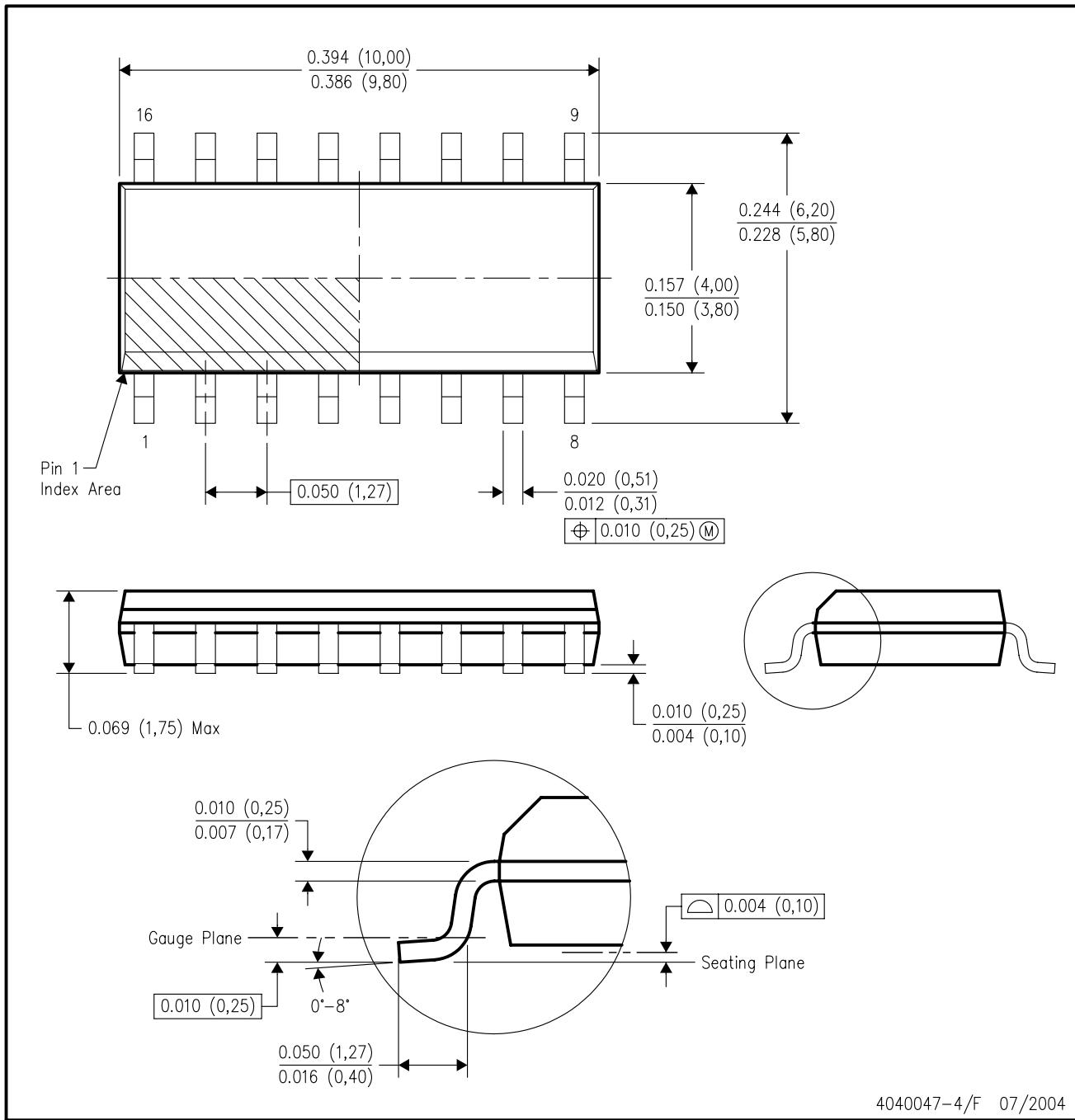
16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



NOTES:

- All linear dimensions are in inches (millimeters).
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- Falls within JEDEC MS-012 variation AC.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



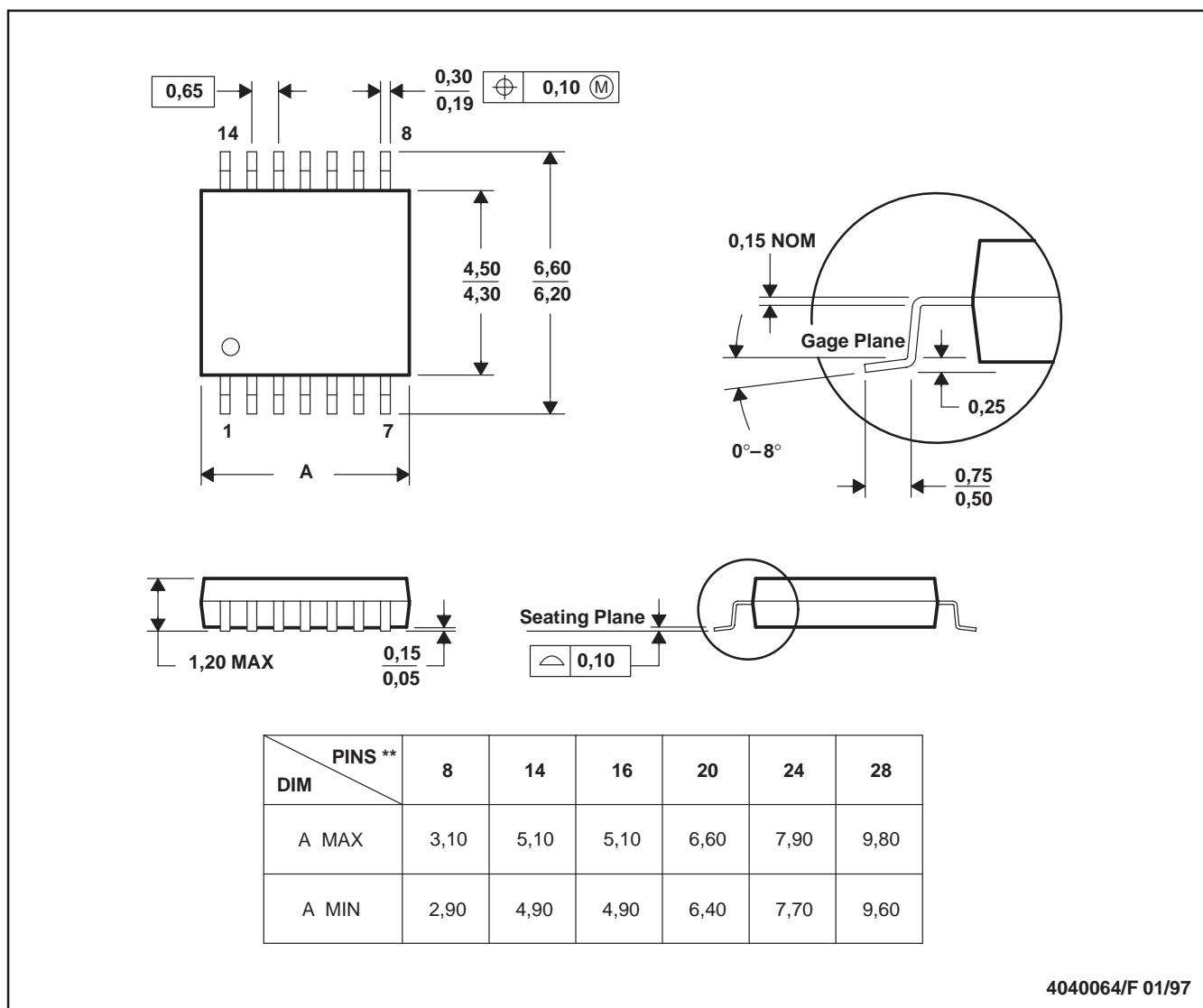
NOTES:

- 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.

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



NOTES:

- All linear dimensions are in millimeters.
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0,15.
- Falls within JEDEC MO-153

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