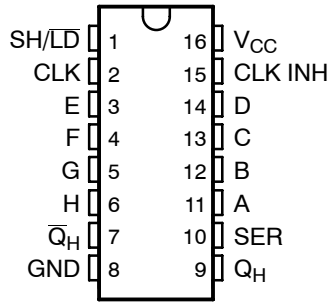
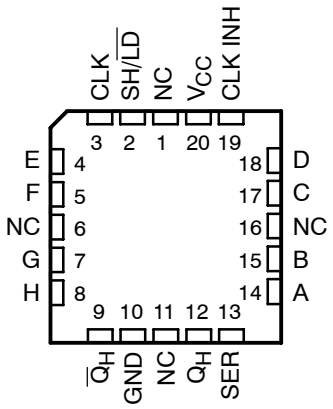
- **Wide Operating Voltage Range of 2 V to 6 V**
- **Outputs Can Drive Up To 10 LSTTL Loads**
- **Low Power Consumption, 80-μA Max I_{CC}**
- **Typical t_{pd} = 13 ns**
- **±4-mA Output Drive at 5 V**
- **Low Input Current of 1 μA Max**
- **Complementary Outputs**
- **Direct Overriding Load (Data) Inputs**
- **Gated Clock Inputs**
- **Parallel-to-Serial Data Conversion**

SN54HC165 . . . J OR W PACKAGE
SN74HC165 . . . D, DB, N, NS, OR PW PACKAGE
(TOP VIEW)



SN54HC165 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

The ’HC165 devices are 8-bit parallel-load shift registers that, when clocked, shift the data toward a serial (Q_H) output. Parallel-in access to each stage is provided by eight individual direct data (A–H) inputs that are enabled by a low level at the shift/load (SH/$\overline{LD}$) input. The ’HC165 devices also feature a clock-inhibit (CLK INH) function and a complementary serial ($\overline{Q}_H$) output.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	PDIP – N	Tube of 25	SN74HC165N	SN74HC165N
	SOIC – D	Tube of 40	SN74HC165D	HC165
		Reel of 2500	SN74HC165DRG3	
		Reel of 250	SN74HC165DT	
	SOP – NS	Reel of 2000	SN74HC165NSR	HC165
	SSOP – DB	Reel of 2000	SN74HC165DBR	HC165
	TSSOP – PW	Tube of 90	SN74HC165PW	HC165
		Reel of 2000	SN74HC165PWR	
		Reel of 250	SN74HC165PWT	
–55°C to 125°C	CDIP – J	Tube of 25	SNJ54HC165J	SNJ54HC165J
	CFP – W	Tube of 150	SNJ54HC165W	SNJ54HC165W
	LCCC – FK	Tube of 55	SNJ54HC165FK	SNJ54HC165FK

† 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.

description/ordering information (continued)

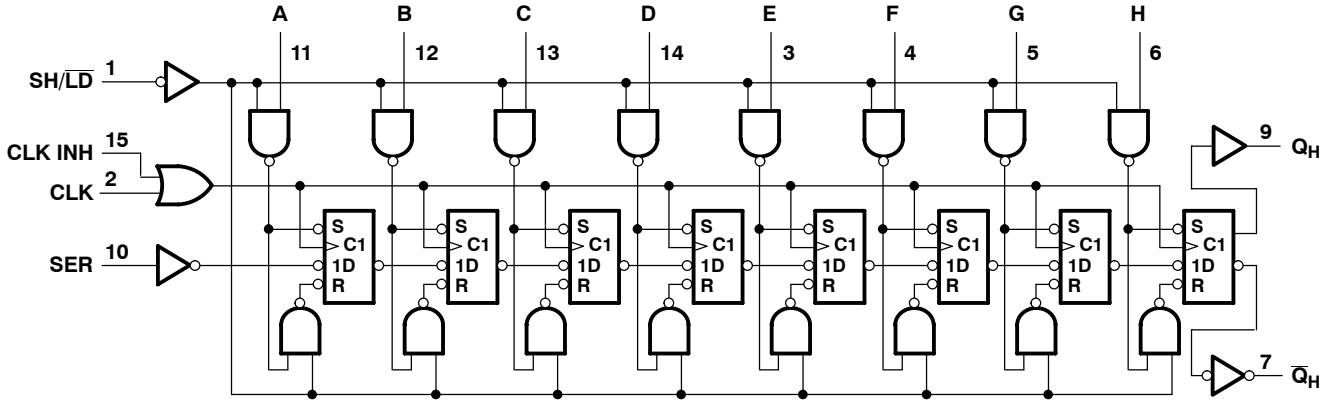
Clocking is accomplished by a low-to-high transition of the clock (CLK) input while SH/$\overline{LD}$ is held high and CLK INH is held low. The functions of CLK and CLK INH are interchangeable. Since a low CLK and a low-to-high transition of CLK INH also accomplish clocking, CLK INH should be changed to the high level only while CLK is high. Parallel loading is inhibited when SH/$\overline{LD}$ is held high. While SH/$\overline{LD}$ is low, the parallel inputs to the register are enabled independently of the levels of the CLK, CLK INH, or serial (SER) inputs.

FUNCTION TABLE

INPUTS			FUNCTION
SH/$\overline{LD}$	CLK	CLK INH	
L	X	X	Parallel load
H	H	X	No change
H	X	H	No change
H	L	↑	Shift†
H	↑	L	Shift†

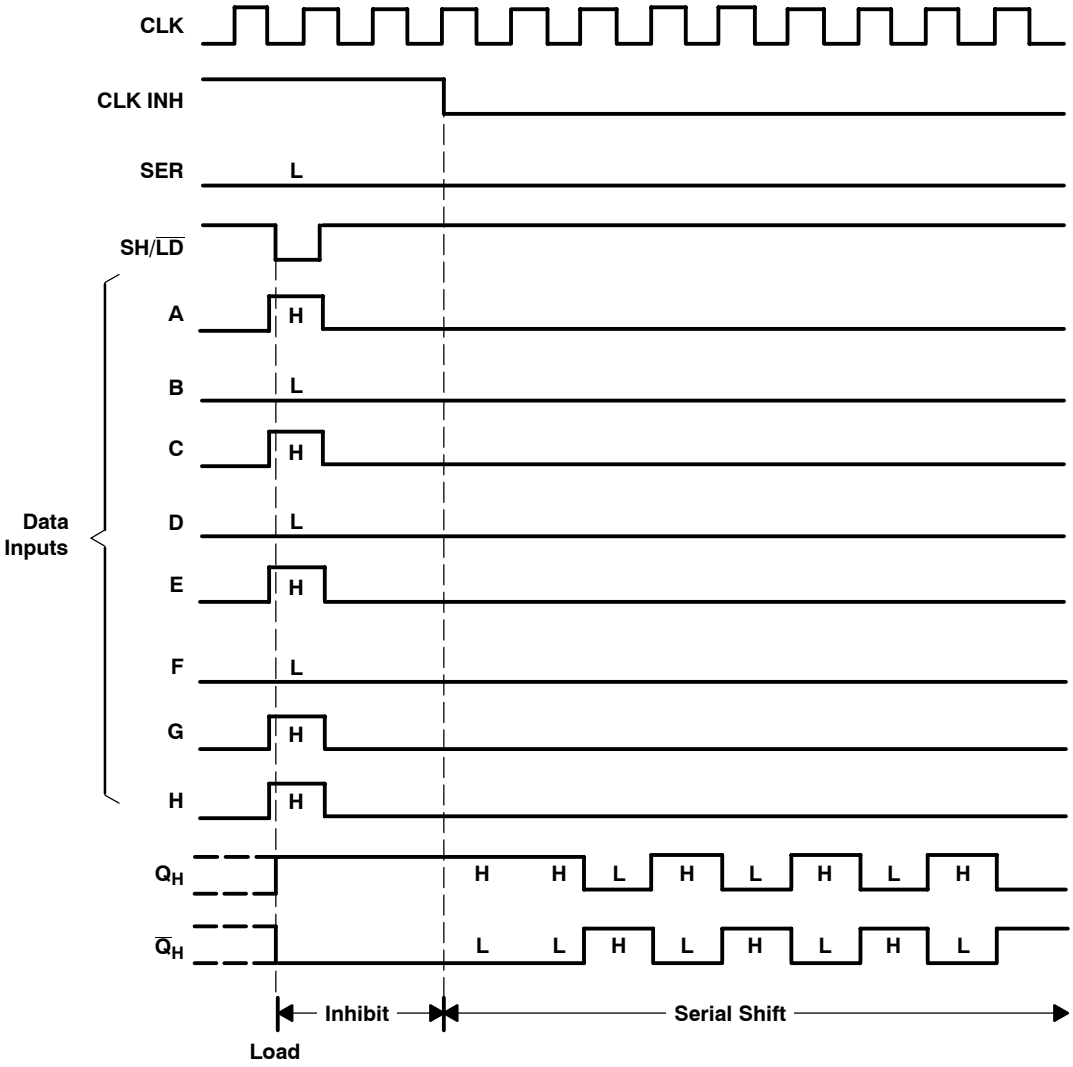
† Shift = content of each internal register shifts toward serial output Q_H. Data at SER is shifted into the first register.

logic diagram (positive logic)



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

typical shift, load, and inhibit sequence



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 Note 1) . . . . . ±20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) (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 . . . . . 73°C/W
DB package . . . . . 82°C/W
N package . . . . . 67°C/W
NS package . . . . . 64°C/W
PW package . . . . . 108°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.

recommended operating conditions (see Note 3)

			SN54HC165			SN74HC165			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
$\Delta t/\Delta v$‡	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.

‡ If this device is used in the threshold region (from V_{IL}max = 0.5 V to V_{IH}min = 1.5 V), there is a potential to go into the wrong state from induced grounding, causing double clocking. Operating with the inputs at t_t = 1000 ns and V_{CC} = 2 V does not damage the device; however, functionally, the CLK inputs are not ensured while in the shift, count, or toggle operating modes.

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

PARAMETER	TEST CONDITIONS		V_{CC}	T_A = 25°C			SN54HC165		SN74HC165		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} = –4 mA	4.5 V	3.98	4.3		3.7		3.84		
		I_{OH} = –5.2 mA	6 V	5.48	5.8		5.2		5.34		
V_{OL}	V_I = V_{IH} or V_{IL}	I_{OL} = 20 μA	2 V		0.002	0.1		0.1		0.1	V
			4.5 V		0.001	0.1		0.1		0.1	
			6 V		0.001	0.1		0.1		0.1	
		I_{OL} = 4 mA	4.5 V		0.17	0.26		0.4		0.33	
		I_{OL} = 5.2 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_{CC}	V_I = V_{CC} or 0, I_O = 0		6 V				8		160		80	μA
C_i			2 V to 6 V		3	10		10		10	pF

timing requirements over recommended operating free-air temperature range (unless otherwise noted)

			V_{CC}	T_A = 25°C		SN54HC165		SN74HC165		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		2 V		6		4.2		5	MHz
			4.5 V		31		21		25	
			6 V		36		25		29	
t_w	Pulse duration	SH/$\overline{LD}$ low	2 V	80		120		100		ns
			4.5 V	16		24		20		
			6 V	14		20		17		
		CLK high or low	2 V	80		120		100		
			4.5 V	16		24		20		
			6 V	14		20		17		
t_{su}	Setup time	SH/$\overline{LD}$ high before CLK↑	2 V	80		120		100		ns
			4.5 V	16		24		20		
			6 V	14		20		17		
		SER before CLK↑	2 V	40		60		50		
			4.5 V	8		12		10		
			6 V	7		10		9		
		CLK INH low before CLK↑	2 V	100		150		125		
			4.5 V	20		30		25		
			6 V	17		25		21		
		CLK INH high before CLK↑	2 V	40		60		50		
			4.5 V	8		12		10		
			6 V	7		10		9		
		Data before SH/$\overline{LD}$↓	2 V	100		150		125		
			4.5 V	20		30		25		
			6 V	17		26		21		
t_h	Hold time	SER data after CLK↑	2 V	5		5		5		ns
			4.5 V	5		5		5		
			6 V	5		5		5		
		PAR data after SH/$\overline{LD}$↓	2 V	5		5		5		
			4.5 V	5		5		5		
			6 V	5		5		5		

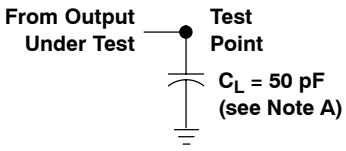
switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	T_A = 25°C			SN54HC165		SN74HC165		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			2 V	6	13		4.2		5		MHz
			4.5 V	31	50		21		25		
			6 V	36	62		25		29		
t_{pd}	SH/$\overline{LD}$	Q_H or $\overline{Q}_H$	2 V		80	150		225		190	ns
			4.5 V		20	30		45		38	
			6 V		16	26		38		32	
	CLK	Q_H or $\overline{Q}_H$	2 V		75	150		225		190	
			4.5 V		15	30		45		38	
			6 V		13	26		38		32	
	H	Q_H or $\overline{Q}_H$	2 V		75	150		225		190	
			4.5 V		15	30		45		38	
			6 V		13	26		38		32	
t_t		Any	2 V		38	75		110		95	ns
			4.5 V		8	15		22		19	
			6 V		6	13		19		16	

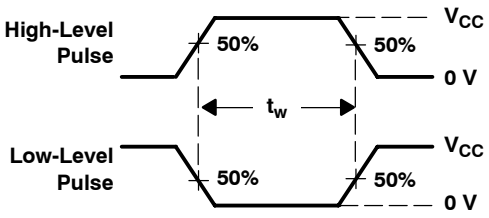
operating characteristics, T_A = 25°C

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance	No load	75	pF

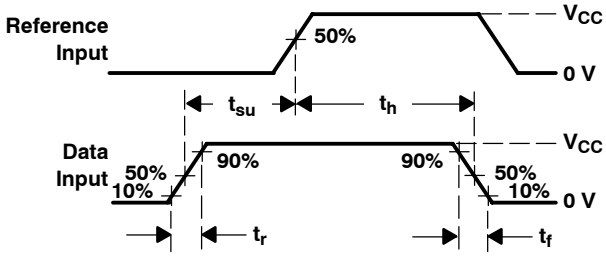
PARAMETER MEASUREMENT INFORMATION



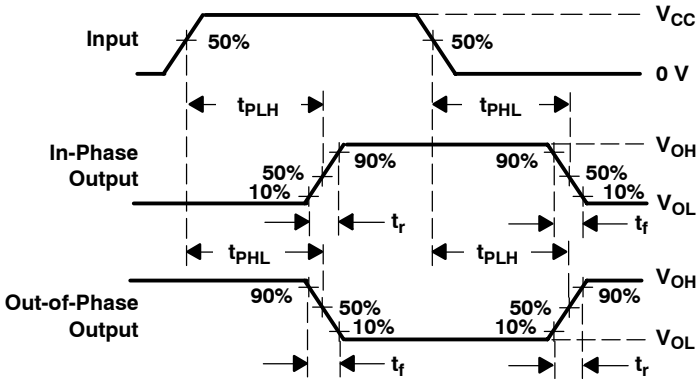
LOAD CIRCUIT



VOLTAGE WAVEFORMS
PULSE DURATIONS



VOLTAGE WAVEFORMS
SETUP AND HOLD AND INPUT RISE AND FALL TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY AND OUTPUT TRANSITION TIMES

NOTES: A. C_L 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 ≤ 1 MHz, Z_O = 50 Ω, t_r = 6 ns, t_f = 6 ns.
C. For clock inputs, f_{max} is measured when the input duty cycle is 50%.
D. The outputs are measured one at a time with one input transition per measurement.
E. t_{PLH} and t_{PHL} are the same as t_{pd}.

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)	Samples (Requires Login)
84095012A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Call TI	
8409501EA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Call TI	
8409501FA	ACTIVE	CFP	W	16	1	TBD	Call TI	Call TI	
SN54HC165J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
SN74HC165D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165DBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165DBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165DBRG4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165DRG3	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	
SN74HC165DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165DT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165DTE4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165DTG4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74HC165N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	
SN74HC165NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/ Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
SN74HC165NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165PWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165PWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165PWLE	OBSOLETE	TSSOP	PW	16		TBD	Call TI	Call TI	
SN74HC165PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165PWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165PWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165PWT	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165PWTE4	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC165PWTG4	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SNJ54HC165FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
SNJ54HC165J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
SNJ54HC165W	ACTIVE	CFP	W	16	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.

OTHER QUALIFIED VERSIONS OF SN54HC165, SN74HC165 :

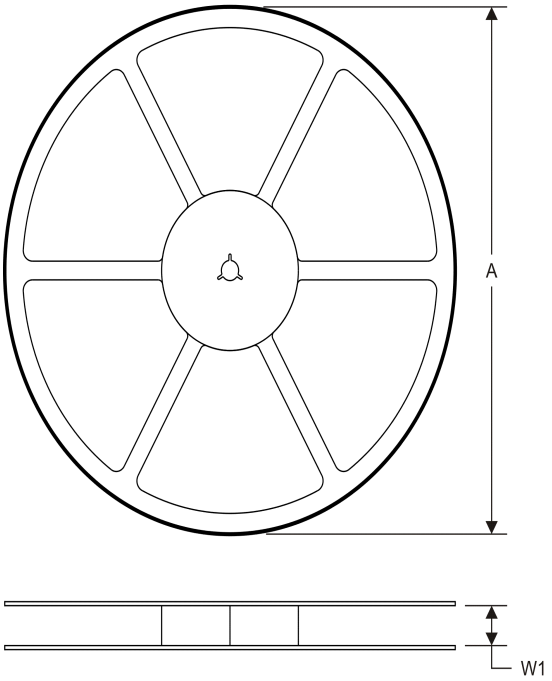
- Catalog: SN74HC165
- Automotive: SN74HC165-Q1, SN74HC165-Q1
- Enhanced Product: SN74HC165-EP, SN74HC165-EP
- Military: SN54HC165

NOTE: Qualified Version Definitions:

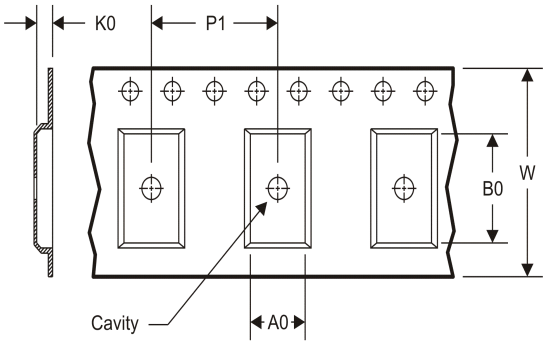
- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



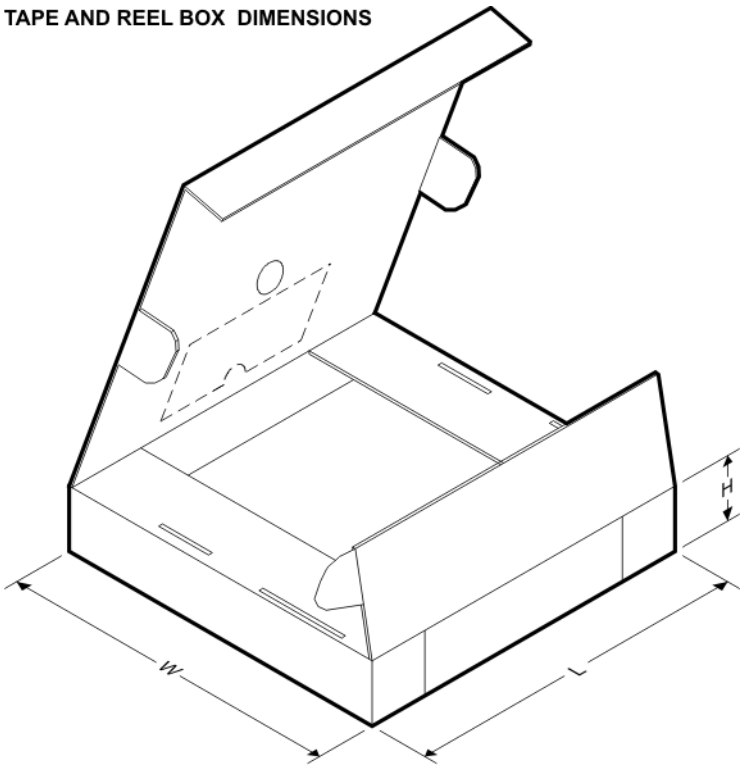
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
SN74HC165DBR	SSOP	DB	16	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
SN74HC165NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74HC165PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74HC165PWR	TSSOP	PW	16	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1
SN74HC165PWT	TSSOP	PW	16	250	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



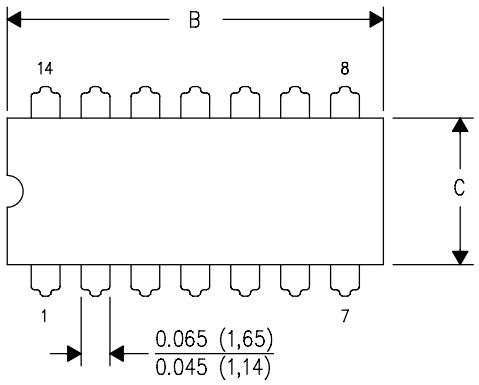
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74HC165DBR	SSOP	DB	16	2000	346.0	346.0	33.0
SN74HC165NSR	SO	NS	16	2000	346.0	346.0	33.0
SN74HC165PWR	TSSOP	PW	16	2000	346.0	346.0	29.0
SN74HC165PWR	TSSOP	PW	16	2000	364.0	364.0	27.0
SN74HC165PWT	TSSOP	PW	16	250	346.0	346.0	29.0

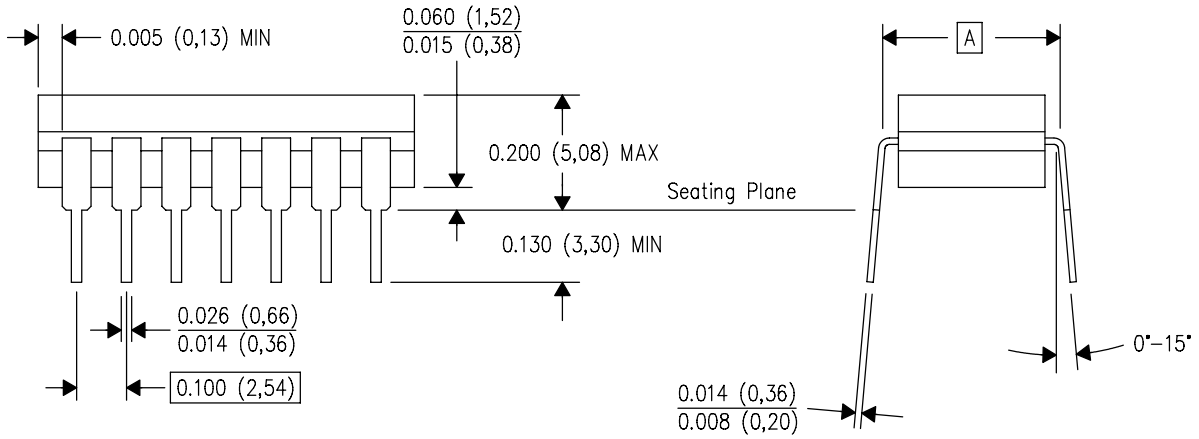
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



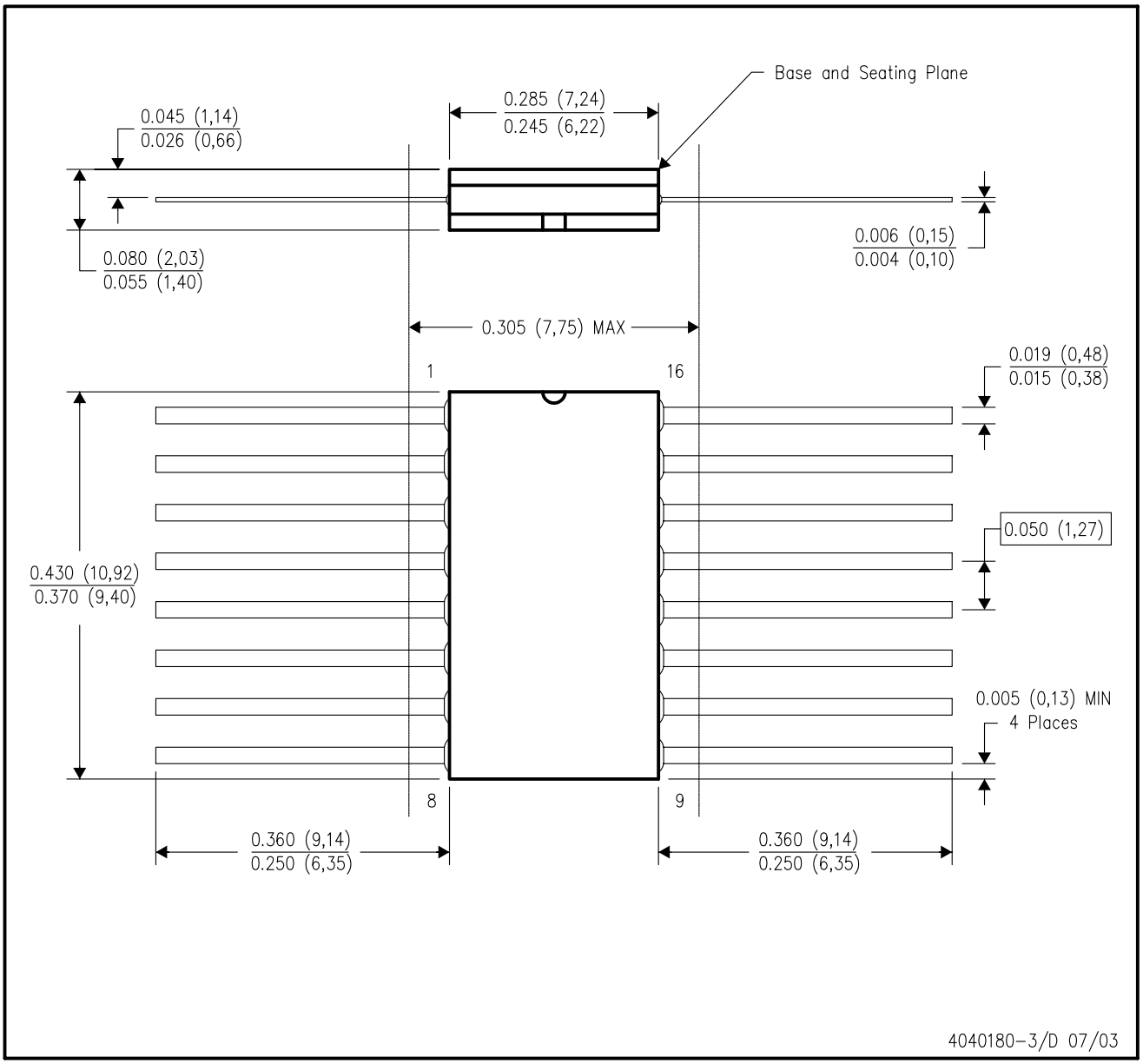
DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



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.

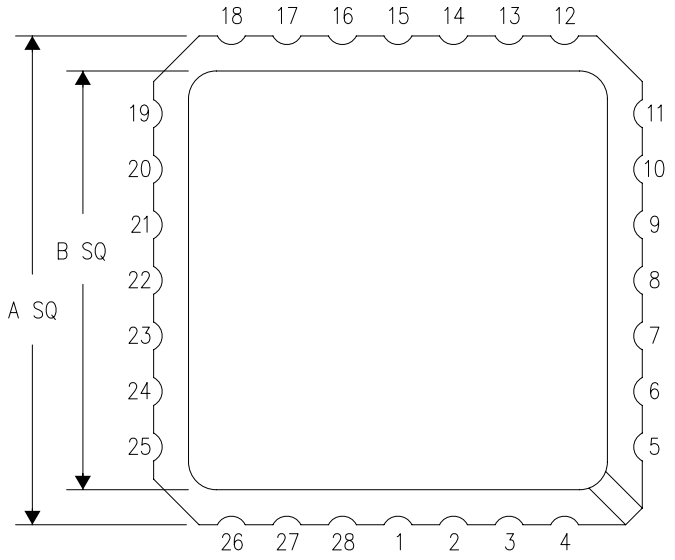
W (R–GDFP–F16) CERAMIC DUAL FLATPACK



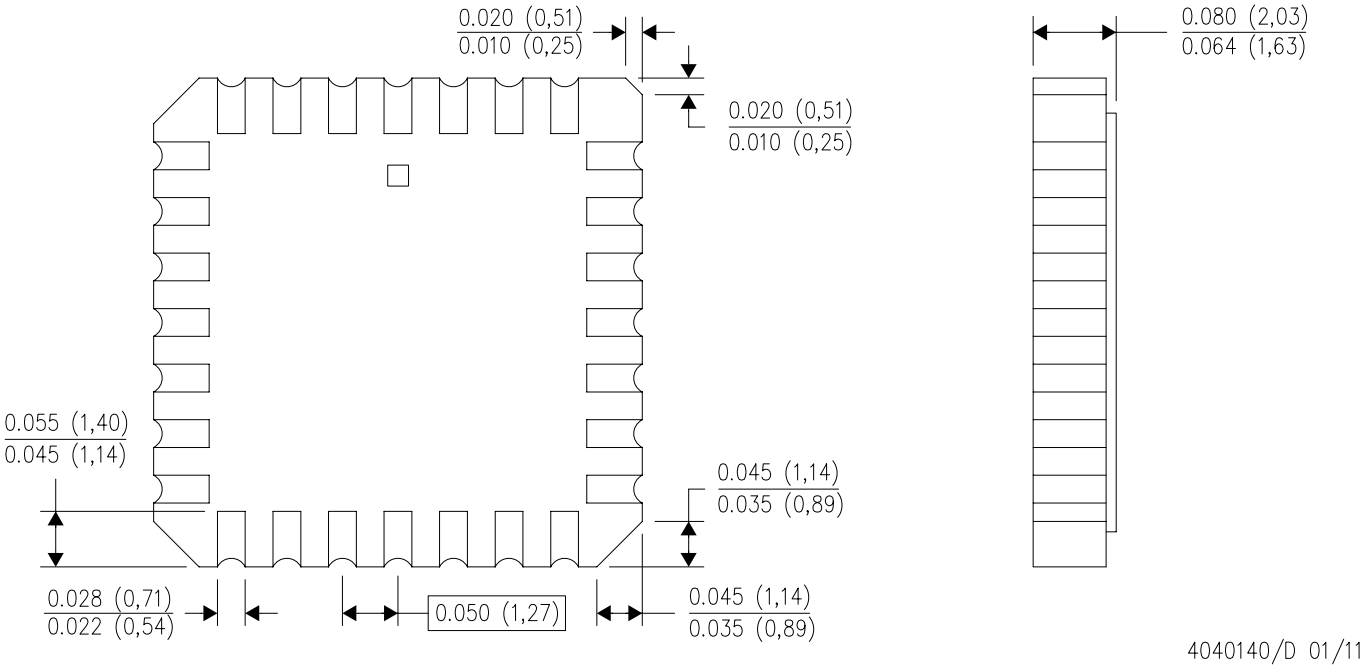
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only.
E. Falls within MIL STD 1835 GDFP1–F16 and JEDEC MO–092AC

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)



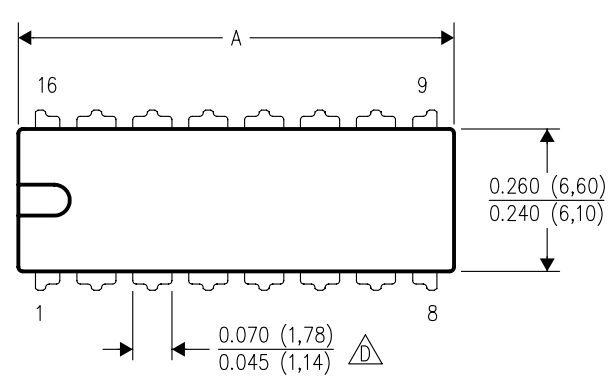
4040140/D 01/11

NOTES:
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

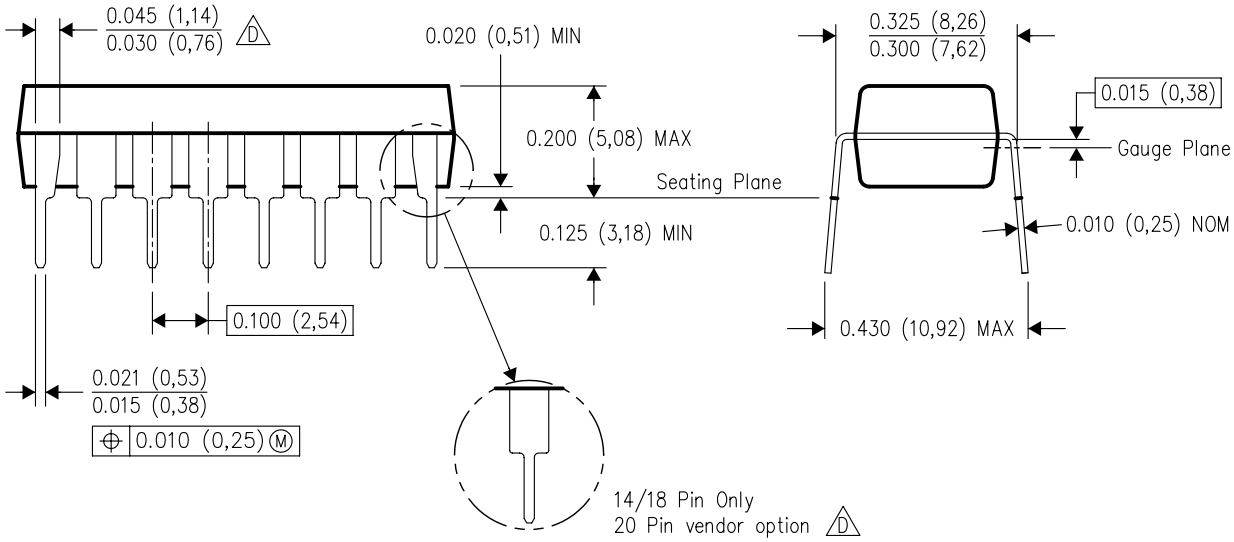
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



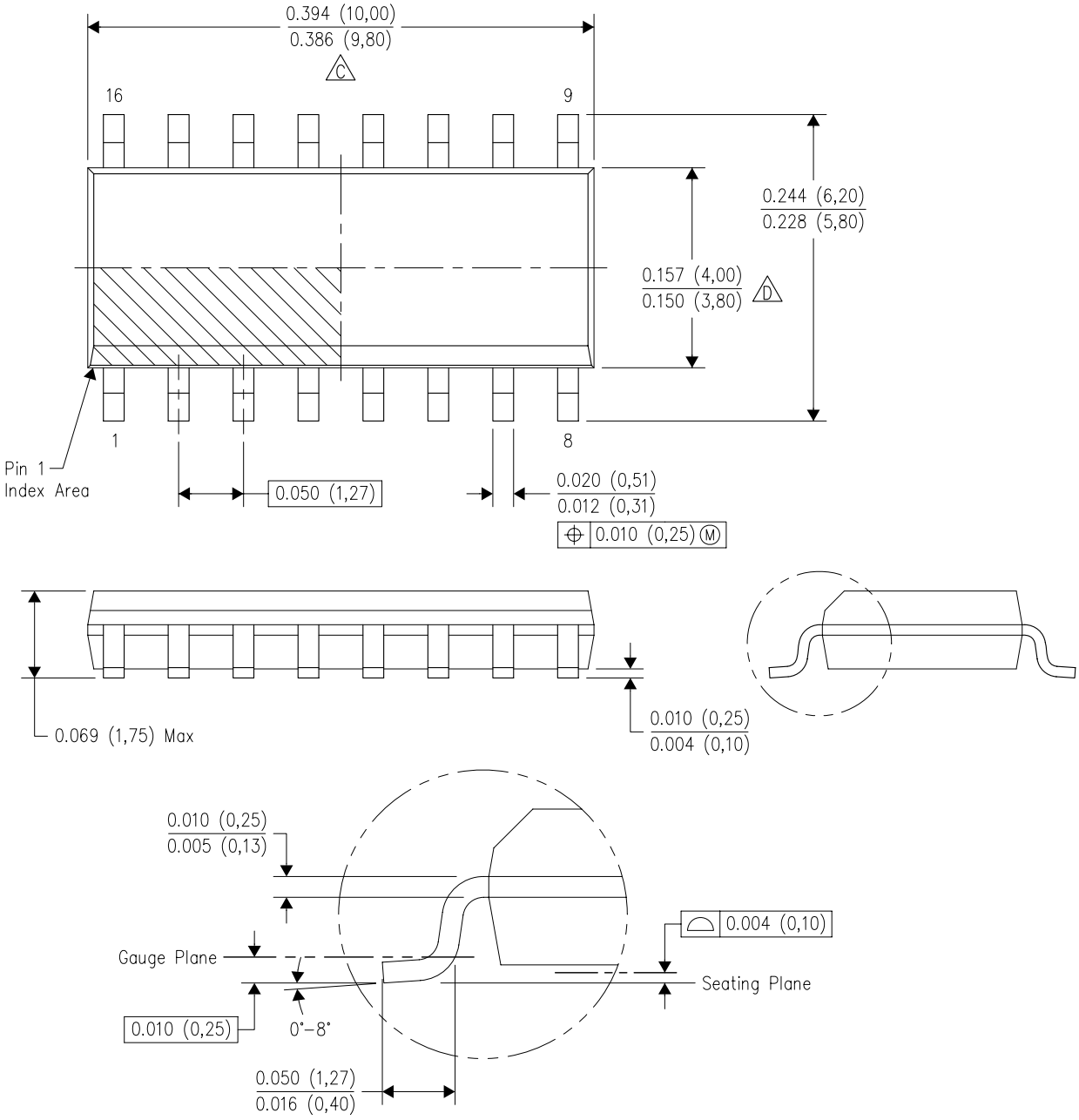
DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

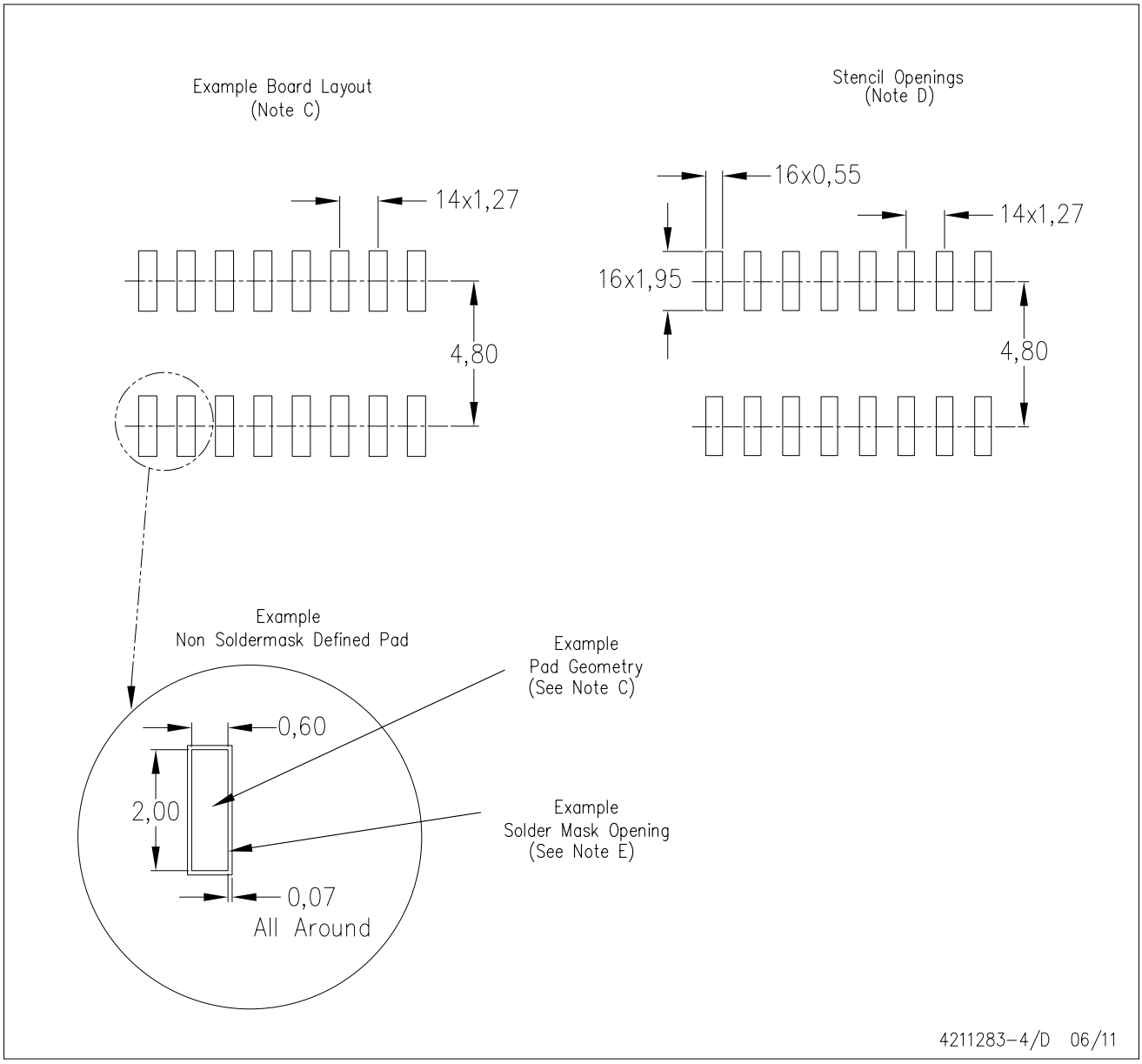
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



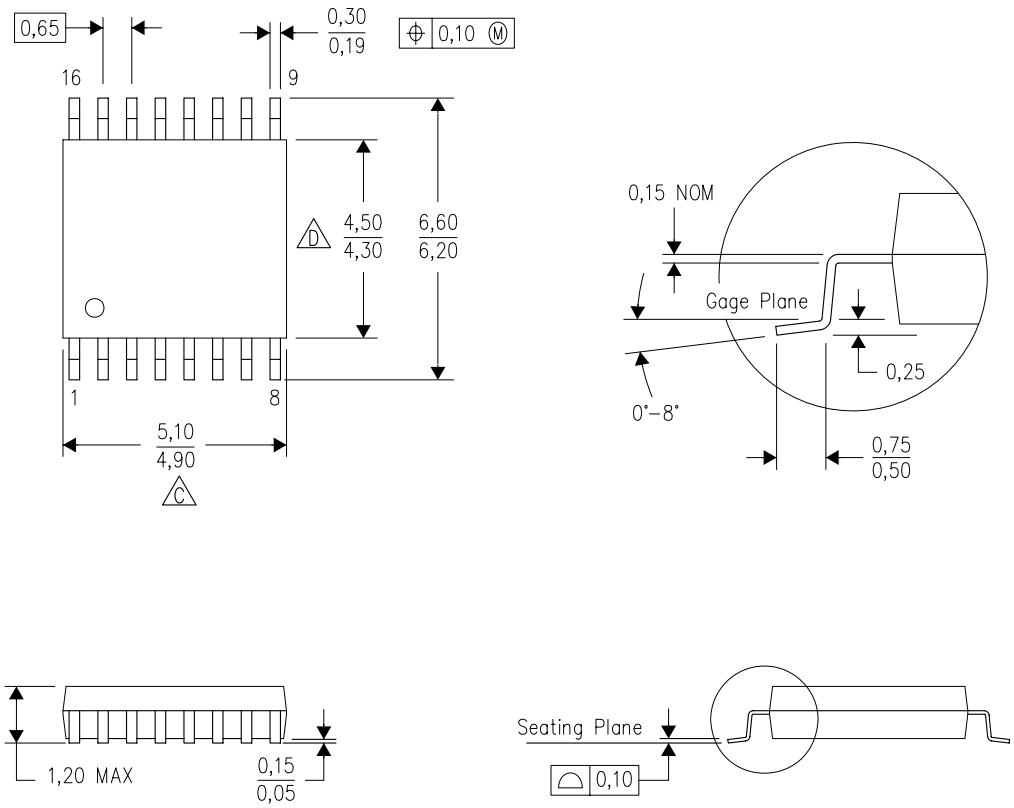
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead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

D (R–PDSO–G16) 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.

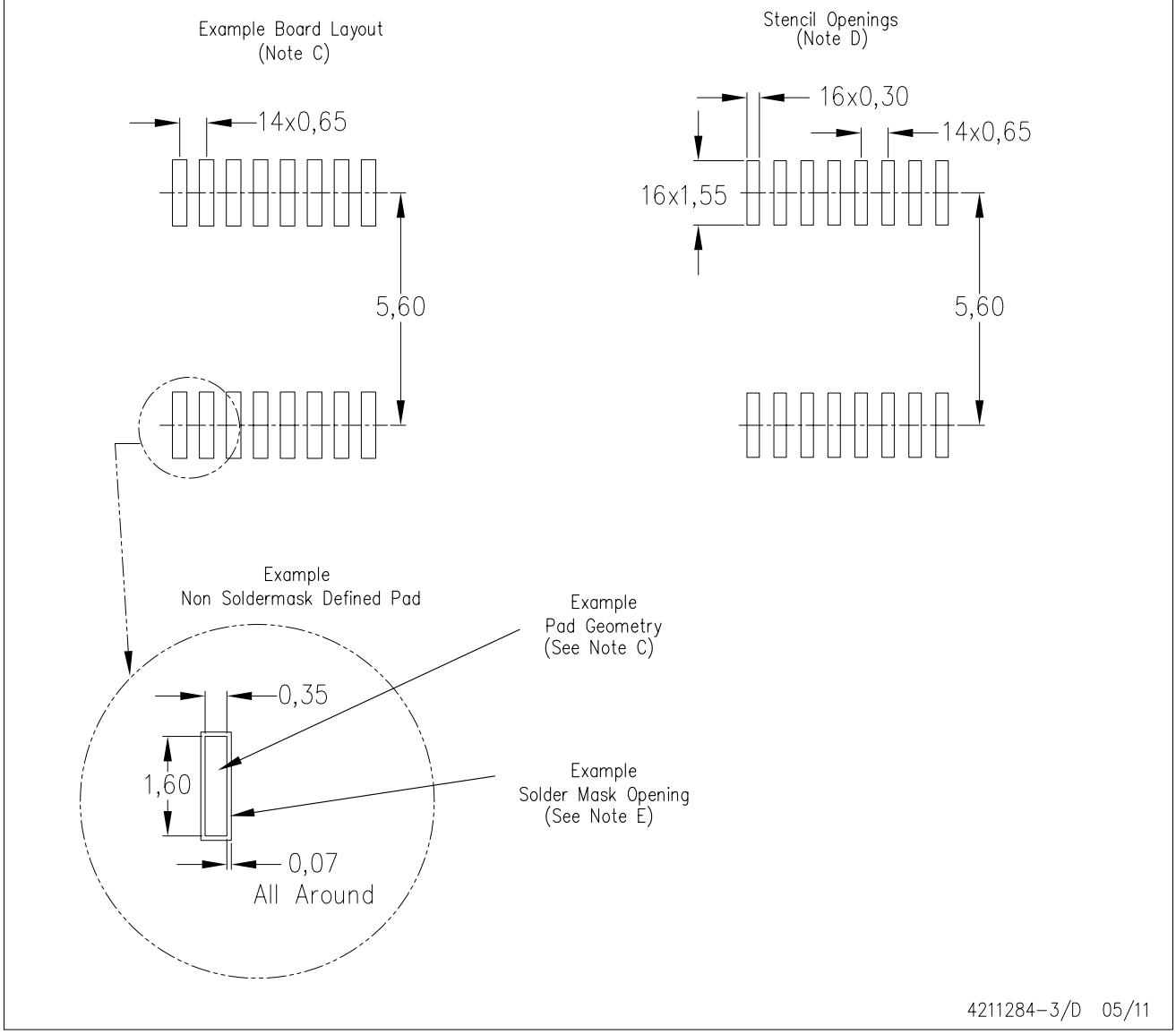
PW (R–PDSO–G16) PLASTIC SMALL OUTLINE



4040064–4/G 02/11

NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
D. 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–G16) PLASTIC SMALL OUTLINE

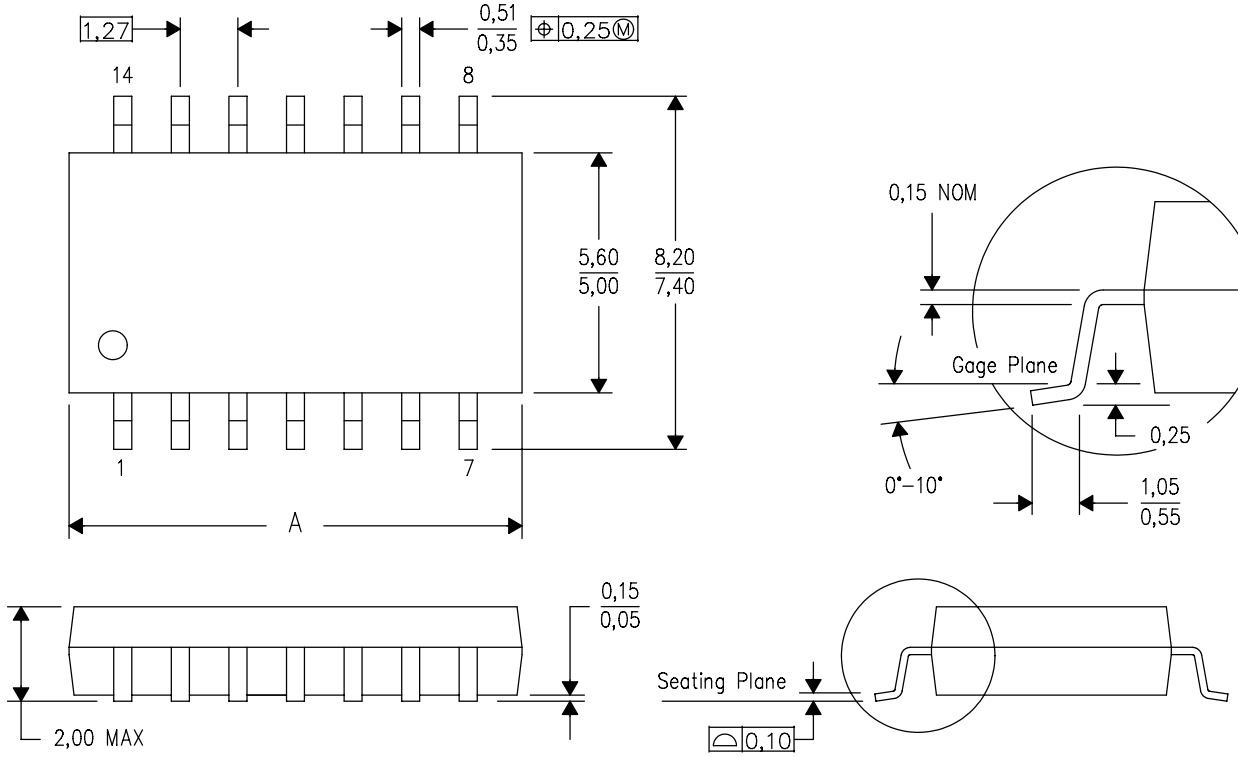


NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact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

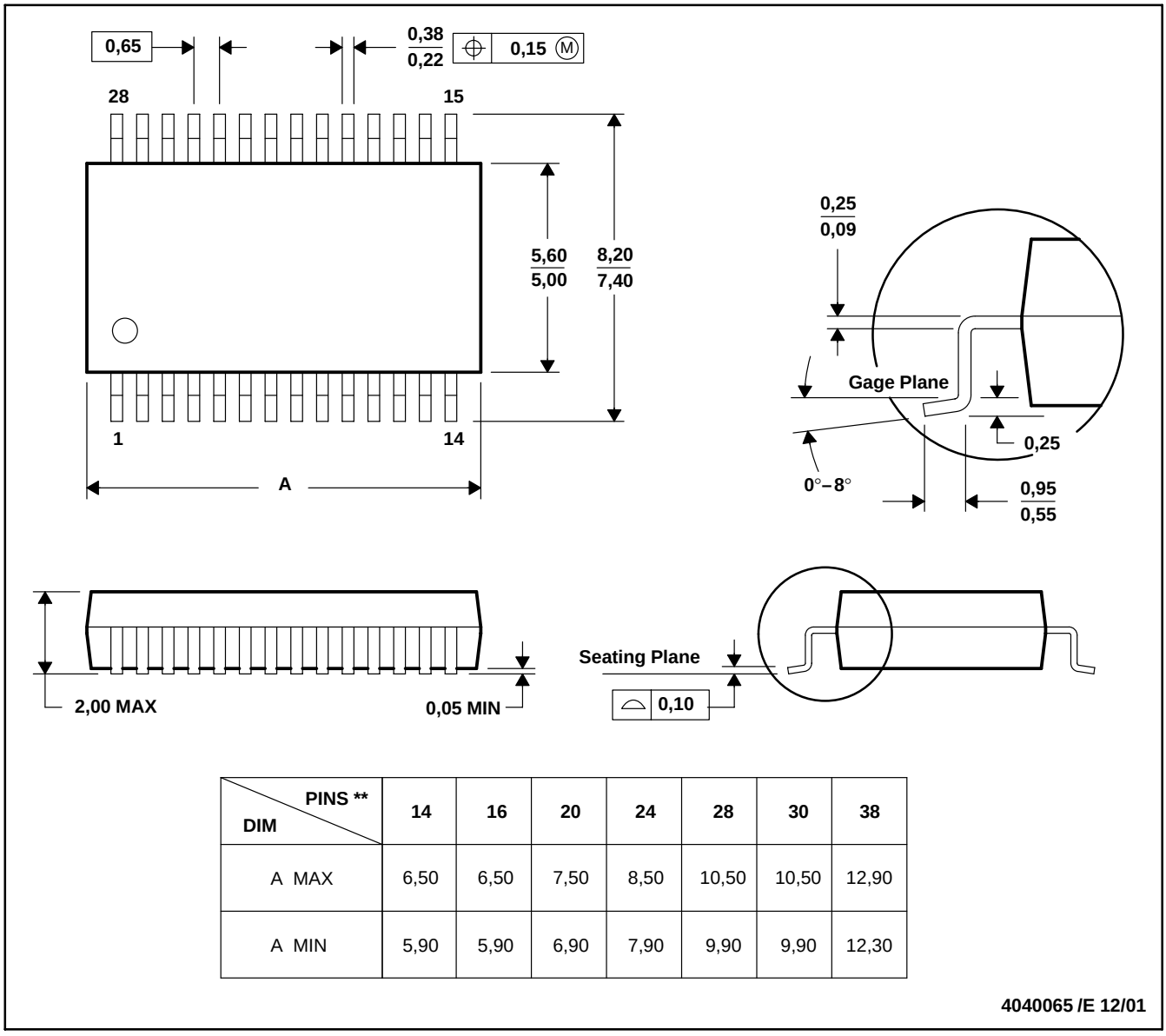
4040062/C 03/03

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.

MSSO002E – JANUARY 1995 – REVISED DECEMBER 2001

DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN



DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

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.
D. Falls within JEDEC MO-150

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