

8-BIT PARALLEL-LOAD SHIFT REGISTERS

Check for Samples: [SN54HC165](#), [SN74HC165](#)

FEATURES

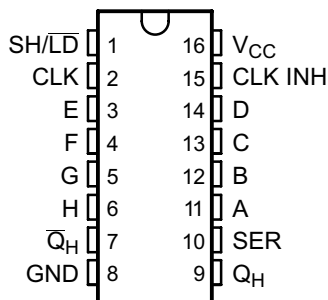
- Wide Operating Voltage Range of 2 V to 6 V
- Outputs Can Drive Up To 10 LSTTL Loads
- Low Power Consumption, 80- μ A Max I_{CC}
- Typical $t_{pd} = 13$ ns
- ± 4 -mA Output Drive at 5 V
- Low Input Current of 1 μ A Max
- Complementary Outputs
- Direct Overriding Load (Data) Inputs
- Gated Clock Inputs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

DESCRIPTION

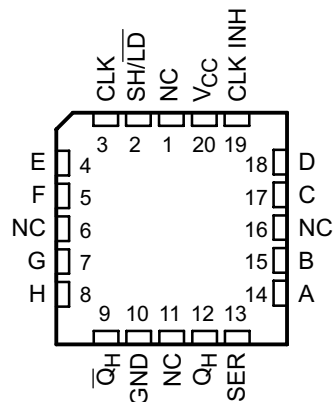
The 'HC165 devices are 8-bit parallel-load shift registers that, when clocked, shift the data toward a serial (Q_H) output. Parallel-in access to each stage is provided by eight individual direct data (A–H) inputs that are enabled by a low level at the shift/load (SH/LD) input. The 'HC165 devices also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

Clocking is accomplished by a low-to-high transition of the clock (CLK) input while SH/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/LD is held high. While SH/LD is low, the parallel inputs to the register are enabled independently of the levels of the CLK, CLK INH, or serial (SER) inputs.

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



SN54HC165 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection



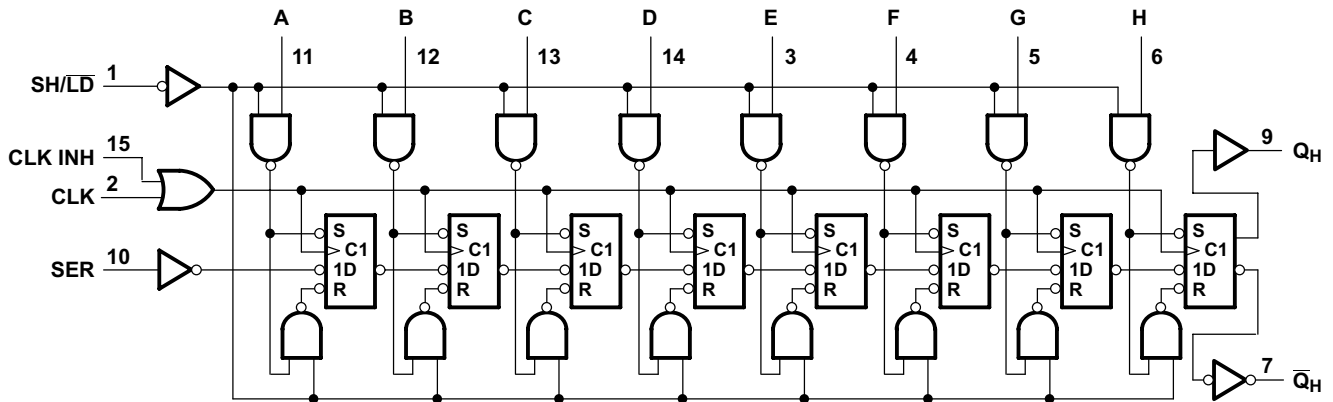
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

FUNCTION TABLE

SH/ $\overline{\text{LD}}$	INPUTS		FUNCTION
	CLK	CLK INH	
L	X	X	Parallel load
H	H	X	No change
H	X	H	No change
H	L	\uparrow	Shift ⁽¹⁾
H	\uparrow	L	Shift ⁽¹⁾

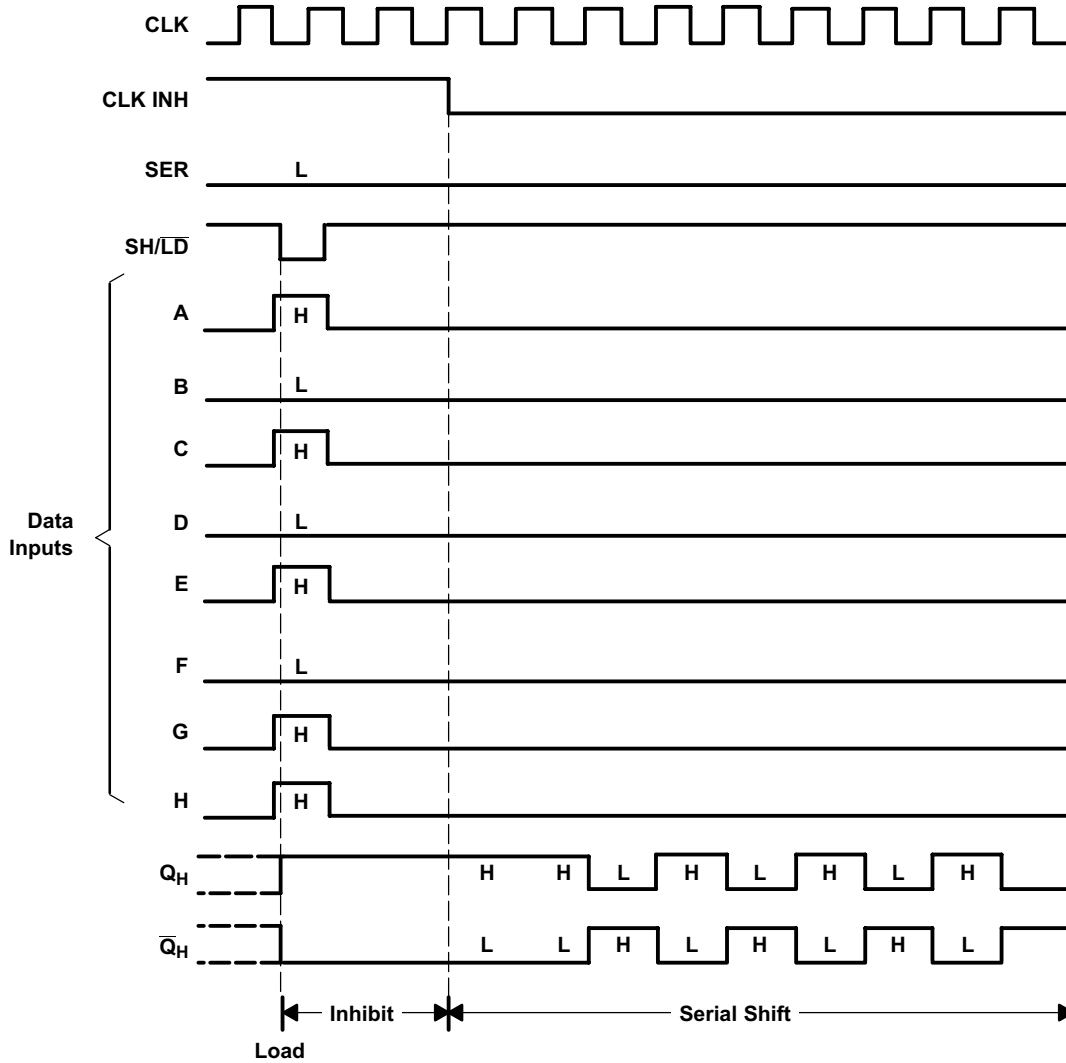
(1) Shift = content of each internal register shifts toward serial output Q_H . Data at SER is shifted into the first register.

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)⁽¹⁾

		VALUE	UNITS
V _{CC}	Supply voltage range	-0.5 to 7	V
I _{IK}	Input clamp current	V _I < 0 or V _I > V _{CC} ⁽²⁾	±20 mA
I _{OK}	Output clamp current	V _O < 0 or V _O > V _{CC} ⁽²⁾	±20 mA
I _O	Continuous output current	V _O = 0 to V _{CC}	±25 mA
Continuous current through V _{CC} or GND		±50	mA
θ _{JA} ⁽³⁾	Package thermal impedance	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
T _{stg}	Storage temperature range	-65 to 150	°C

- (1) 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.
- (2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS⁽¹⁾

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

		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		V	
		V _{CC} = 4.5 V			1.35			
		V _{CC} = 6 V			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 ⁽²⁾	Input transition rise/fall time	V _{CC} = 2 V			1000		ns	
		V _{CC} = 4.5 V			500			
		V _{CC} = 6 V			400			
T _A	Operating free-air temperature	-55		125	-40		125	°C

- (1) 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](#).
- (2) 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_i = 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 –55°C TO 125°C		SN74HC165 –40°C TO 85°C		Recommended SN74HC165 –40°C TO 125°C		UNIT
				MIN	TYP	MAX	MIN	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		1.9	V	
			4.5 V	4.4	4.499		4.4		4.4		4.4		
			6 V	5.9	5.999		5.9		5.9		5.9		
		I _{OH} = –4 mA	4.5 V	3.98	4.3		3.7		3.84		3.7		
			6 V	5.48	5.8		5.2		5.34		5.2		
V _{OL}	V _I = V _{IH} or V _{IL}	I _{OL} = 20 μA	2 V		0.002	0.1	0.1		0.1		0.1	V	
			4.5 V		0.001	0.1	0.1		0.1		0.1		
			6 V		0.001	0.1	0.1		0.1		0.1		
		I _{OL} = 4 mA	4.5 V		0.17	0.26	0.4		0.33		0.4		
			6 V		0.15	0.26	0.4		0.33		0.4		
I _I	V _I = V _{CC} or 0		6 V		±0.1	±100	±1000		±1000		±1000	nA	
I _{CC}	V _I = V _{CC} or 0,	I _O = 0	6 V			8	160		80		160	μA	
C _i			2 V to 6 V		3	10	10		10		10	pF	

TIMING REQUIREMENTS

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

			V _{CC}	T _A = 25°C		SN54HC165 –55°C TO 125°C		SN74HC165 –40°C TO 85°C		Recommended SN74HC165 –40°C TO 125°C		UNIT			
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX				
f _{clock}	Clock frequency		2 V	6		4.2		5		4.2		MHz			
			4.5 V	31		21		25		21					
			6 V	36		25		29		25					
t _w	Pulse duration	SH/ $\overline{\text{LD}}$ low	2 V	80		120		100		120		ns			
			4.5 V	16		24		20		24					
			6 V	14		20		17		20					
		CLK high or low	2 V	80		120		100		120					
			4.5 V	16		24		20		24					
			6 V	14		20		17		20					
t _{su}	Setup time	SH/ $\overline{\text{LD}}$ high before CLK \uparrow	2 V	80		120		100		120		ns			
			4.5 V	16		24		20		24					
			6 V	14		20		17		20					
		SER before CLK \uparrow	2 V	40		60		50		60					
			4.5 V	8		12		10		12					
			6 V	7		10		9		10					
		CLK INH low before CLK \uparrow	2 V	100		150		125		150					
			4.5 V	20		30		25		30					
			6 V	17		25		21		25					
		CLK INH high before CLK \uparrow	2 V	40		60		50		60					
			4.5 V	8		12		10		12					
			6 V	7		10		9		10					
		Data before SH/ $\overline{\text{LD}}$ \downarrow	2 V	100		150		125		150					
			4.5 V	20		30		25		30					
			6 V	17		26		21		26					
		t _h	Hold time	SER data after CLK \uparrow	2 V	5		5		5			5		ns
					4.5 V	5		5		5			5		
					6 V	5		5		5			5		
PAR data after SH/ $\overline{\text{LD}}$ \downarrow	2 V			5		5		5		5					
	4.5 V			5		5		5		5					
	6 V			5		5		5		5					

SWITCHING CHARACTERISTICS

 over recommended operating free-air temperature range, $C_L = 50$ pF (unless otherwise noted) (see [Figure 3](#))

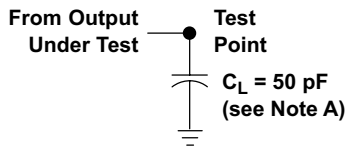
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	$T_A = 25^\circ\text{C}$			SN54HC165 –55°C TO 125°C		SN74HC165 –40°C TO 85°C		Recommended SN74HC165 –40°C TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
f_{max}			2 V	6	13		4.2		5		4.2	MHz	
			4.5 V	31	50		21		25		21		
			6 V	36	62		25		29		25		
t_{pd}	SH/ $\overline{\text{LD}}$	Q_H or \overline{Q}_H	2 V		80	150		225		190		225	ns
			4.5 V		20	30		45		38		45	
			6 V		16	26		38		32		38	
	CLK	Q_H or \overline{Q}_H	2 V		75	150		225		190		225	
			4.5 V		15	30		45		38		45	
			6 V		13	26		38		32		38	
	H	Q_H or \overline{Q}_H	2 V		75	150		225		190		225	
			4.5 V		15	30		45		38		45	
			6 V		13	26		38		32		38	
t_t		Any	2 V		38	75		110		95		110	ns
			4.5 V		8	15		22		19		22	
			6 V		6	13		19		16		19	

OPERATING CHARACTERISTICS

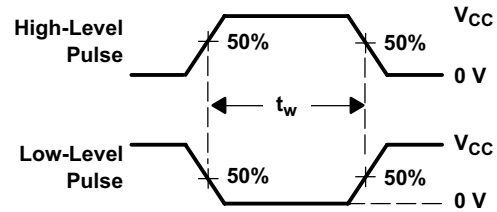
 $T_A = 25^\circ\text{C}$

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

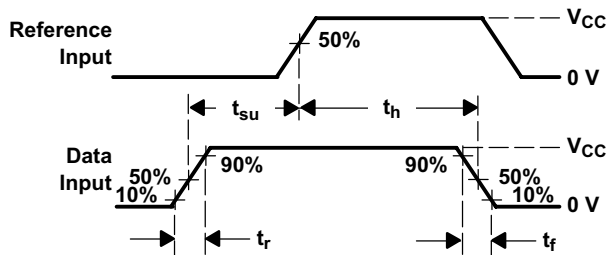
PARAMETER MEASUREMENT INFORMATION



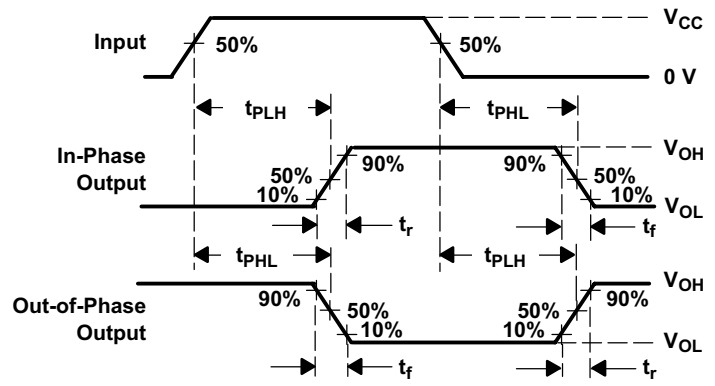
LOAD CIRCUIT



**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: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 6 \text{ ns}$, $t_f = 6 \text{ ns}$.
 - 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

REVISION HISTORY

Changes from Revision F (December 2010) to Revision G	Page
• Extended maximum temperature operating range from 85°C to 125°C.	4

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
84095012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	84095012A SNJ54HC 165FK	Samples
8409501EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	8409501EA SNJ54HC165J	Samples
8409501FA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	8409501FA SNJ54HC165W	Samples
SN54HC165J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54HC165J	Samples
SN74HC165D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165DBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165DRG3	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165DT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU CU SN	N / A for Pkg Type	-40 to 125	SN74HC165N	Samples
SN74HC165N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	-40 to 125		
SN74HC165NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 125	SN74HC165N	Samples
SN74HC165NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74HC165NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165PWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165PWLE	OBSOLETE	TSSOP	PW	16		TBD	Call TI	Call TI	-40 to 125		
SN74HC165PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165PWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165PWRG3	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165PWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SN74HC165PWT	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC165	Samples
SNJ54HC165FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	84095012A SNJ54HC 165FK	Samples
SNJ54HC165J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	8409501EA SNJ54HC165J	Samples
SNJ54HC165W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	8409501FA SNJ54HC165W	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) 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.

⁽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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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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

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
SN74HC165DBR	SSOP	DB	16	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
SN74HC165DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74HC165DR	SOIC	D	16	2500	330.0	16.8	6.5	10.3	2.1	8.0	16.0	Q1
SN74HC165DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74HC165DRG3	SOIC	D	16	2500	330.0	16.8	6.5	10.3	2.1	8.0	16.0	Q1
SN74HC165DRG4	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74HC165DRG4	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	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	6.9	5.6	1.6	8.0	12.0	Q1
SN74HC165PWRG3	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74HC165PWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	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	367.0	367.0	38.0
SN74HC165DR	SOIC	D	16	2500	333.2	345.9	28.6
SN74HC165DR	SOIC	D	16	2500	364.0	364.0	27.0
SN74HC165DR	SOIC	D	16	2500	367.0	367.0	38.0
SN74HC165DRG3	SOIC	D	16	2500	364.0	364.0	27.0
SN74HC165DRG4	SOIC	D	16	2500	367.0	367.0	38.0
SN74HC165DRG4	SOIC	D	16	2500	333.2	345.9	28.6
SN74HC165PWR	TSSOP	PW	16	2000	364.0	364.0	27.0
SN74HC165PWR	TSSOP	PW	16	2000	367.0	367.0	35.0
SN74HC165PWRG3	TSSOP	PW	16	2000	364.0	364.0	27.0
SN74HC165PWRG4	TSSOP	PW	16	2000	367.0	367.0	35.0
SN74HC165PWT	TSSOP	PW	16	250	367.0	367.0	35.0

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)

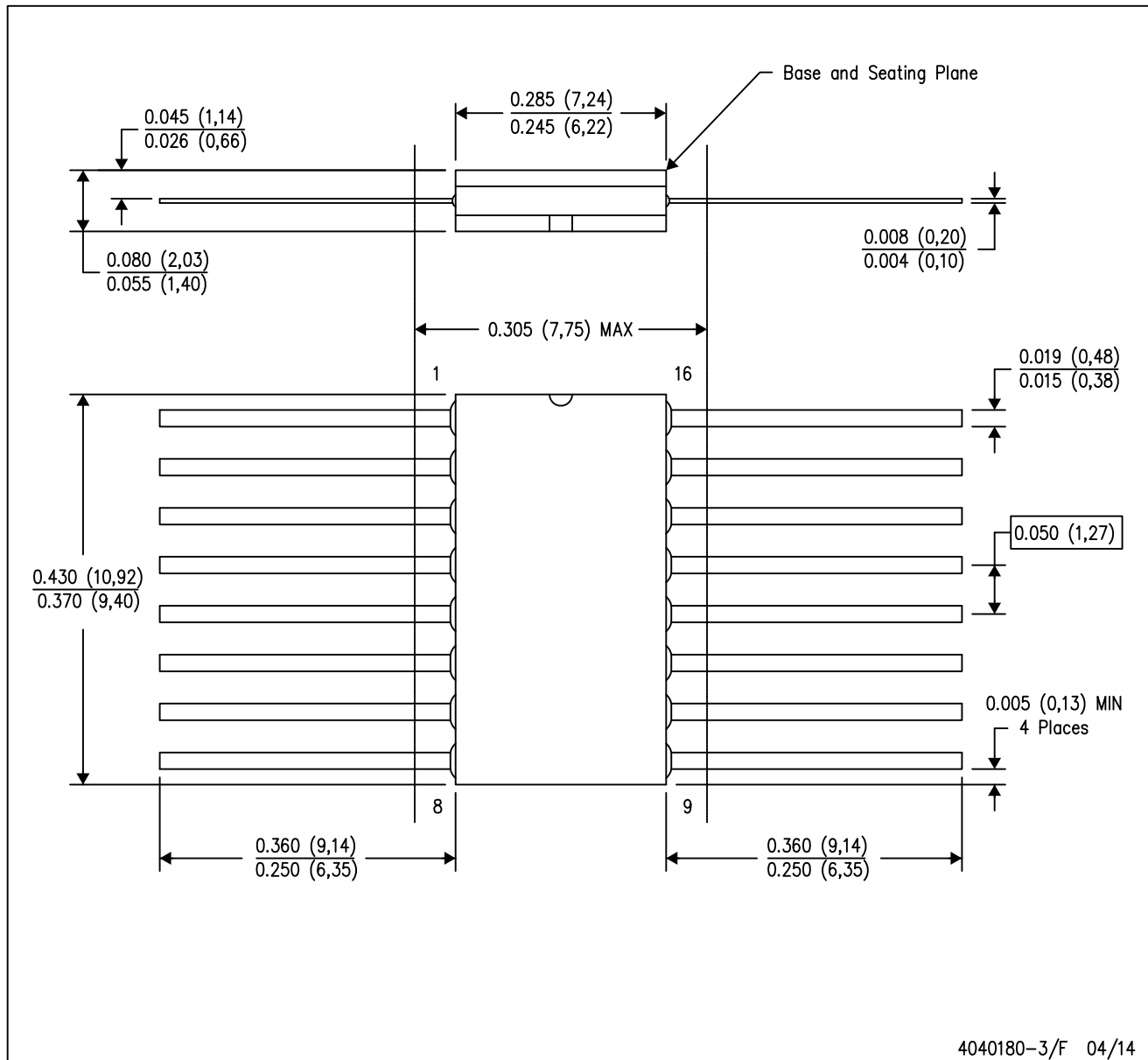


4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package is hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - 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 GDFP2-F16

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**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN





- 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-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  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.
 -  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)

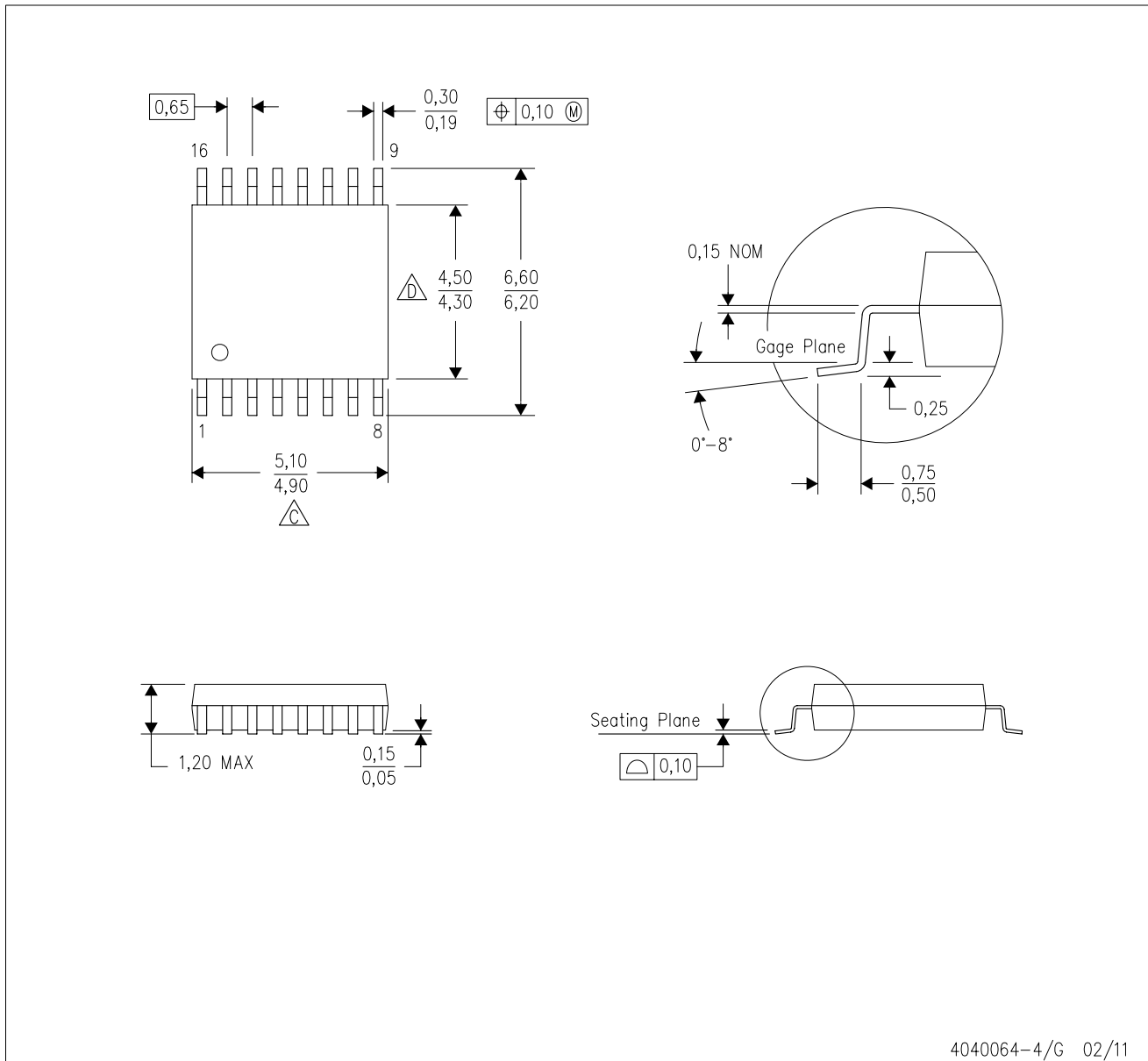
PLASTIC SMALL OUTLINE



- 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

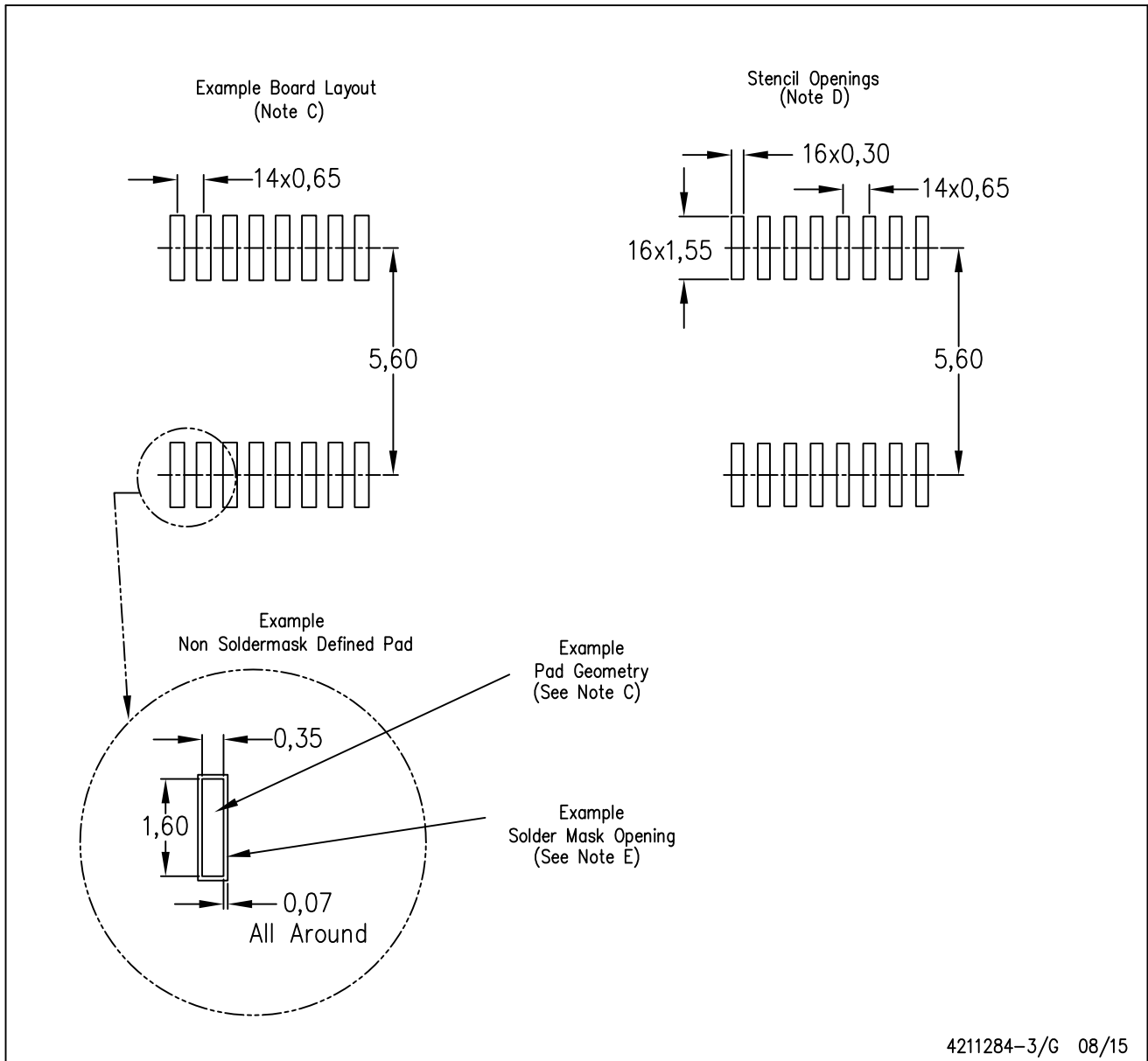


4040064-4/G 02/11

- 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:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - 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.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 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.
 D. Falls within JEDEC MO-150

4040065 /E 12/01

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.