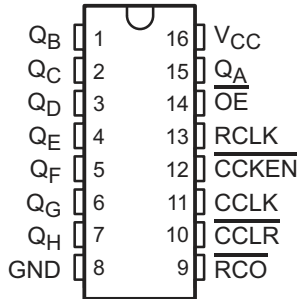


SN54HC590A, SN74HC590A 8-BIT BINARY COUNTERS WITH 3-STATE OUTPUT REGISTERS

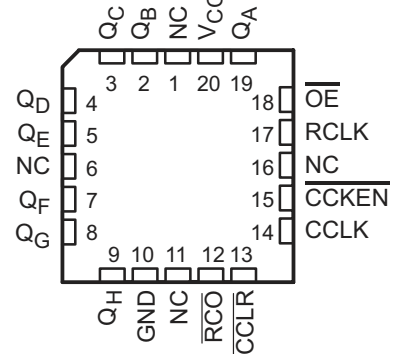
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- 2-V to 6-V V_{CC} Operation
- High-Current 3-State Parallel Register Outputs Can Drive Up To 15 LSTTL Loads
- Low Power Consumption, 80- μ A Max I_{CC}
- Typical $t_{pd} = 14$ ns
- ± 6 -mA Output Drive at 5 V
- Low Input Current of 1 μ A Max
- 8-Bit Counter With Register
- Counter Has Direct Clear

SN54HC590A . . . J OR W PACKAGE
SN74HC590A . . . D, DW, OR N PACKAGE
(TOP VIEW)



SN54HC590A . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

description/ordering information

The 'HC590A devices contain an 8-bit binary counter that feeds an 8-bit storage register. The storage register has parallel outputs. Separate clocks are provided for both the binary counter and storage register. The binary counter features direct clear (\overline{CCLR}) and count-enable (\overline{CCKEN}) inputs. A ripple-carry output (\overline{RCO}) is provided for cascading. Expansion is accomplished easily for two stages by connecting \overline{RCO} of the first stage to \overline{CCKEN} of the second stage. Cascading for larger count chains can be accomplished by connecting \overline{RCO} of each stage to the counter clock (CCLK) input of the following stage.

CCLK and the register clock (RCLK) inputs are positive-edge triggered. If both clocks are connected together, the counter state always is one count ahead of the register. Internal circuitry prevents clocking from the clock enable.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	PDIP - N	Tube of 25	SN74HC590AN	SN74HC590AN
	SOIC - D	Tube of 40	SN74HC590AD	HC590A
		Reel of 2500	SN74HC590ADR	
		Reel of 250	SN74HC590ADT	
	SOIC - DW	Tube of 40	SN74HC590ADW	HC590A
		Reel of 2000	SN74HC590ADWR	
-55°C to 125°C	CDIP - J	Tube of 25	SNJ54HC590AJ	SNJ54HC590AJ
	CFP - W	Tube of 150	SNJ54HC590AW	SNJ54HC590AW
	LCCC - FK	Tube of 55	SNJ54HC590AFK	SNJ54HC590AFK

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



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS
INSTRUMENTS**

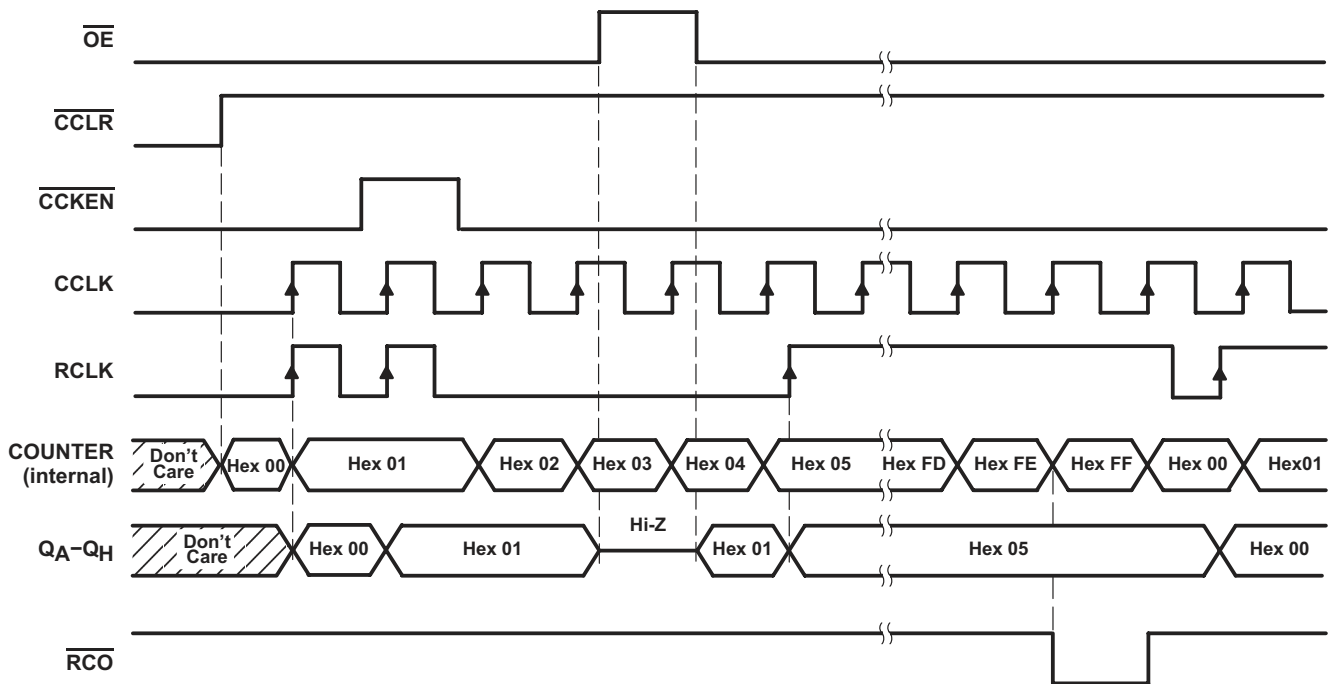
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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS

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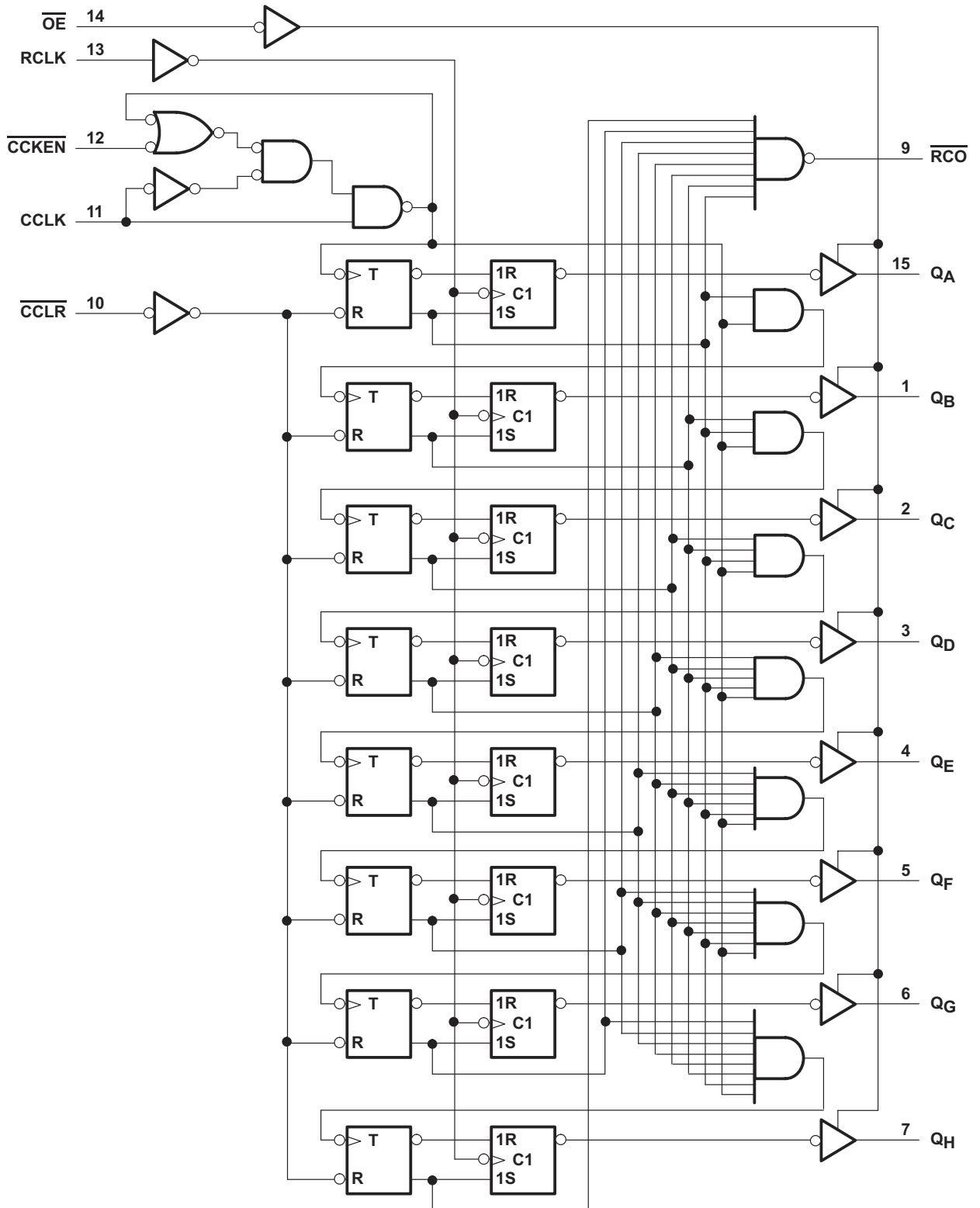
timing diagram



TIMING SEQUENCE

1. Clear Counter (asynchronous).
2. Count up: 0x01. Store 0x00 in register.
3. Inhibit counter clock (**CCKEN** = HIGH). Store 0x01 in register.
4. Count 0x02, 0x03.
5. 3-state the outputs
6. Count up: 0x04
7. Enable outputs.
8. Continue up: 0x05
9. Store 0x05 in register.
10. Continue counting: 0x06...0xFD, 0xFE, 0xFF, 0x00, etc.
11. Store 0x00 in register.

logic diagram (positive logic)



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



SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS
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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS		V _{CC}	T _A = 25°C			SN54HC590A		SN74HC590A		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		
		4.5 V	\overline{RCO} , I _{OH} = -4 mA	3.98	4.3		3.7		3.84		
			Q _A -Q _H , I _{OH} = -6 mA	3.98	4.3		3.7		3.84		
		6 V	\overline{RCO} , I _{OH} = -5.2 mA	5.48	5.8		5.2		5.34		
			Q _A -Q _H , I _{OH} = -7.8 mA	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		
		4.5 V	\overline{RCO} , I _{OL} = 4 mA		0.17	0.26		0.4	0.33		
			Q _A -Q _H , I _{OL} = 6 mA		0.17	0.26		0.4	0.33		
		6 V	\overline{RCO} , I _{OL} = 5.2 mA		0.15	0.26		0.4	0.33		
			Q _A -Q _H , I _{OL} = 7.8 mA		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	80	μA		
C _i		2 V to 6 V		3	10		10	10	pF		



SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS

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

		V _{CC}	T _A = 25°C		SN54HC590A		SN74HC590A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f _{clock}	Clock frequency	2 V	4		2.5		3.2		MHz
		4.5 V	20		13		16		
		6 V	24		16		19		
t _w	CCLK or RCLK high or low	2 V	125		200		155		ns
		4.5 V	25		38		31		
		6 V	21		32		26		
	CCLR low	2 V	100		150		125		
		4.5 V	20		30		25		
		6 V	17		26		21		
t _{su}	CCKEN low before CCLK↑	2 V	100		150		125		ns
		4.5 V	20		30		25		
		6 V	17		26		21		
	CCLR high (inactive) before CCLK↑	2 V	100		150		125		
		4.5 V	20		30		25		
		6 V	17		26		21		
	CCLK↑ before RCLK↑†	2 V	100		150		125		
		4.5 V	20		30		25		
		6 V	17		26		21		
t _h	CCKEN low after CCLK↑	2 V	50		75		60		ns
		4.5 V	10		15		12		
		6 V	9		13		11		

† This setup time ensures that the register gets stable data from the counter outputs. The clocks may be tied together, in which case the register is one clock pulse behind the counter.



SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS
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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}	SN54HC590A				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
f _{max}			2 V	4	8	2.5	MHz		
			4.5 V	20	35	13			
			6 V	24	40	16			
t _{pd}	CCLK↑	\overline{RCO}	2 V		80	150	225	ns	
			4.5 V		20	31	45		
			6 V		15	26	38		
t _{PLH}	\overline{CCLR} ↓	\overline{RCO}	2 V		70	130	195	ns	
			4.5 V		18	28	39		
			6 V		14	23	33		
t _{pd}	RCLK↑	Q	2 V		70	140	210	ns	
			4.5 V		18	31	42		
			6 V		14	25	36		
t _{en}	\overline{OE} ↓	Q	2 V		80	125	185	ns	
			4.5 V		20	30	37		
			6 V		15	28	31		
t _{dis}	\overline{OE} ↑	Q	2 V		80	125	185	ns	
			4.5 V		20	30	37		
			6 V		15	28	31		
t _t [*]		\overline{RCO}	2 V		38	75	110	ns	
			4.5 V		8	15	22		
			6 V		6	13	19		
		Q	2 V		38	60	90		
			4.5 V		8	12	18		
			6 V		6	10	15		

* This parameter is not production tested for the SN54HC590A.



SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS

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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}	SN74HC590A				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
f _{max}			2 V	4	8	3.2	MHz		
			4.5 V	20	35	16			
			6 V	24	40	19			
t _{pd}	CCLK↑	\overline{RCO}	2 V	80	150	190	ns		
			4.5 V	20	30	38			
			6 V	15	26	33			
t _{PLH}	\overline{CCLR} ↓	\overline{RCO}	2 V	70	130	165	ns		
			4.5 V	18	26	33			
			6 V	14	22	28			
t _{pd}	RCLK↑	Q	2 V	70	140	175	ns		
			4.5 V	18	28	35			
			6 V	14	24	30			
t _{en}	\overline{OE} ↓	Q	2 V	80	125	155	ns		
			4.5 V	20	25	31			
			6 V	15	21	26			
t _{dis}	\overline{OE} ↑	Q	2 V	80	125	155	ns		
			4.5 V	20	25	31			
			6 V	15	21	26			
t _t		\overline{RCO}	2 V	38	75	95	ns		
			4.5 V	8	15	19			
			6 V	6	13	16			
		Q	2 V	38	60	75			
			4.5 V	8	12	15			
			6 V	6	10	13			



SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS
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switching characteristics over recommended operating free-air temperature range, $C_L = 150$ pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	SN54HC590A				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
t _{pd}	RCLK↑	Q	2 V	100	300	447	ns		
			4.5 V	24	60	90			
			6 V	20	51	77			
t _{en}	\overline{OE}	Q	2 V	90	200	300	ns		
			4.5 V	23	40	60			
			6 V	19	34	51			
t _t *		Q	2 V	45	210	315	ns		
			4.5 V	17	42	63			
			6 V	13	36	53			

* This parameter is not production tested for the SN54HC590A.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	SN74HC590A				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
t _{pd}	RCLK↑	Q	2 V	100	300	380	ns		
			4.5 V	24	60	76			
			6 V	20	51	65			
t _{en}	\overline{OE}	Q	2 V	90	200	250	ns		
			4.5 V	23	40	50			
			6 V	19	34	43			
t _t		Q	2 V	45	210	265	ns		
			4.5 V	17	42	53			
			6 V	13	36	45			

operating characteristics, T_A = 25°C

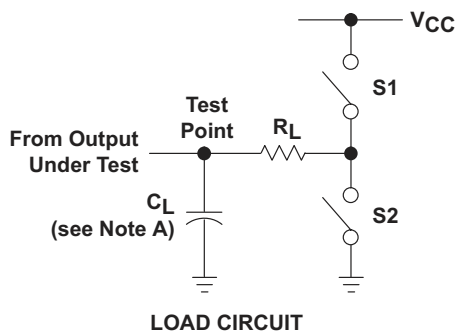
PARAMETER	TEST CONDITIONS	TYP	UNIT
C _{pd} Power dissipation capacitance	No load	250	pF



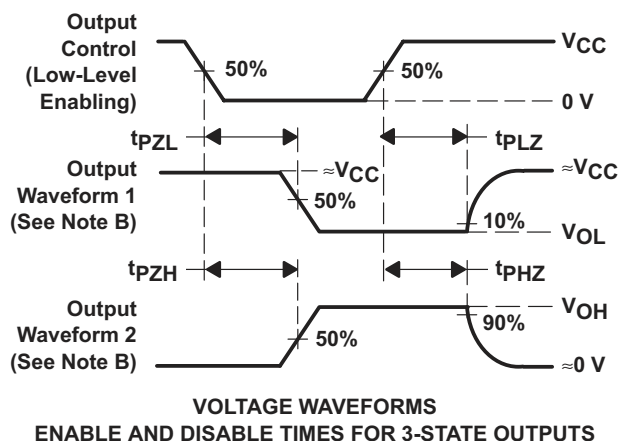
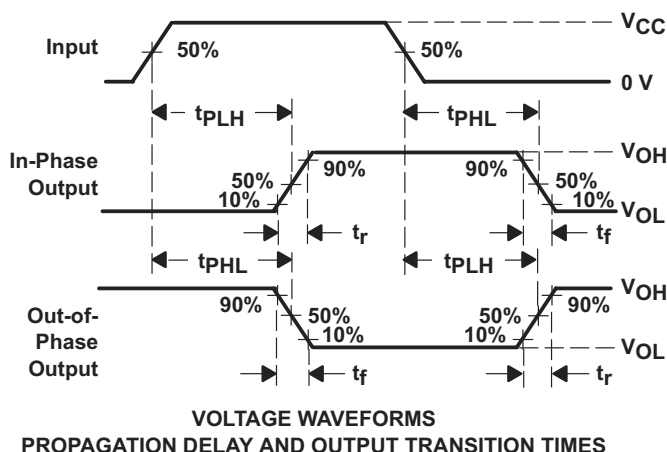
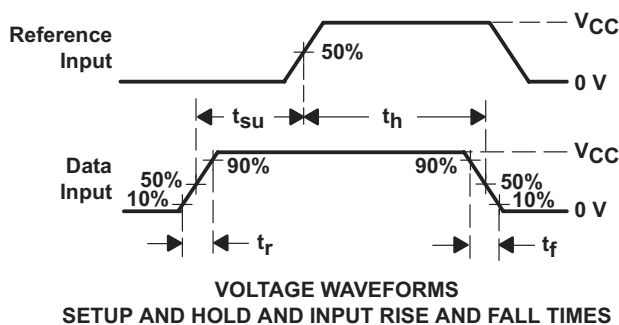
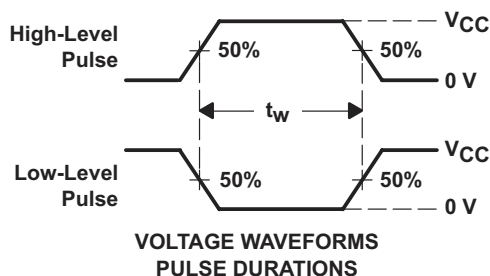
SN54HC590A, SN74HC590A
8-BIT BINARY COUNTERS
WITH 3-STATE OUTPUT REGISTERS

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PARAMETER MEASUREMENT INFORMATION



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



- NOTES:
- A. C_L includes probe and test-fixture 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. 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.
 - D. The outputs are measured one at a time with one input transition per measurement.
 - E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - F. t_{PZL} and t_{PZH} are the same as t_{en} .
 - G. t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms



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PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-89603012A	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
5962-8960301EA	ACTIVE	CDIP	J	16	1	None	Call TI	Level-NC-NC-NC
5962-8960301FA	ACTIVE	CFP	W	16	1	None	Call TI	Level-NC-NC-NC
SN54HC590AJ	ACTIVE	CDIP	J	16	1	None	Call TI	Level-NC-NC-NC
SN74HC590AD	ACTIVE	SOIC	D	16	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
SN74HC590ADR	ACTIVE	SOIC	D	16	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
SN74HC590ADT	ACTIVE	SOIC	D	16	250	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
SN74HC590ADW	ACTIVE	SOIC	DW	16	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
SN74HC590ADWR	ACTIVE	SOIC	DW	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
SN74HC590AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74HC590AN3	OBSOLETE	PDIP	N	16		None	Call TI	Call TI
SNJ54HC590AFK	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
SNJ54HC590AJ	ACTIVE	CDIP	J	16	1	None	Call TI	Level-NC-NC-NC
SNJ54HC590AW	ACTIVE	CFP	W	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 JEDEC industry standard classifications, and peak solder temperature.

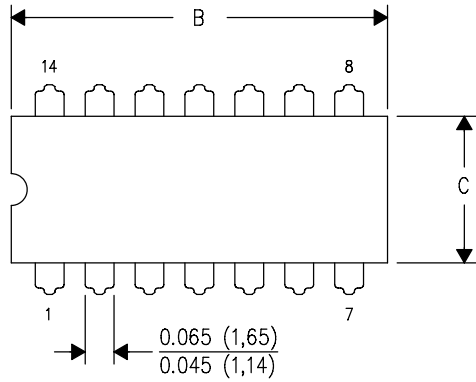
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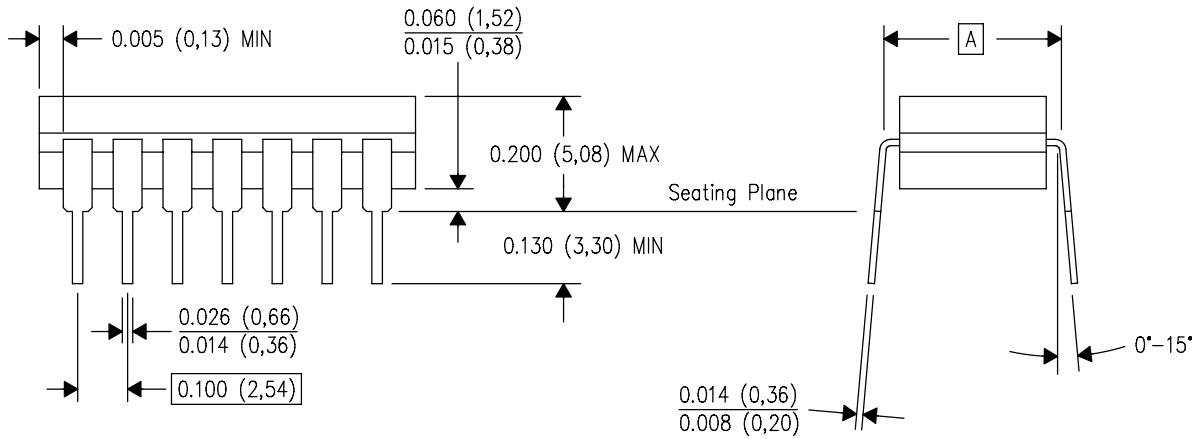
J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
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)

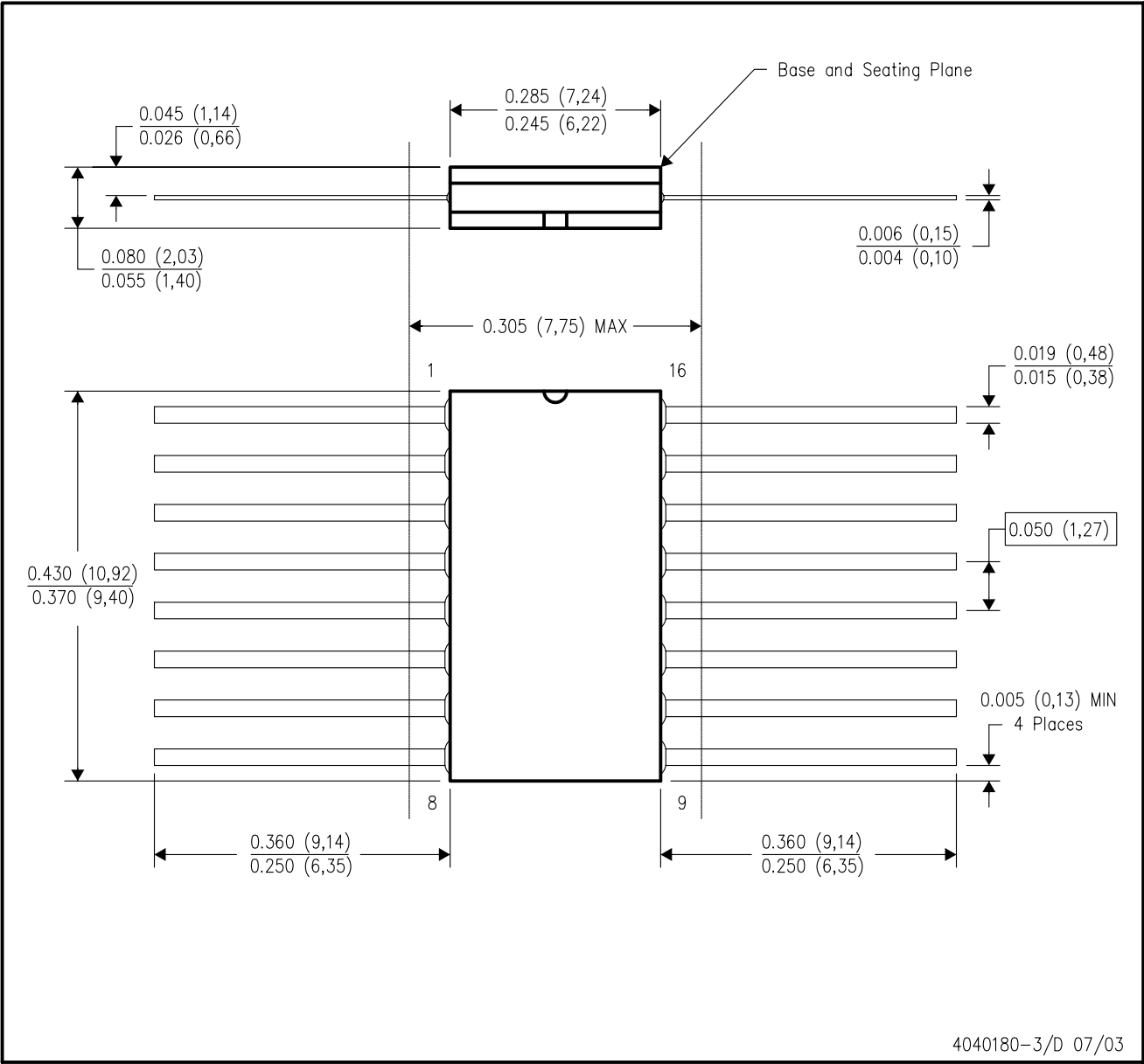


4040083/F 03/03

- 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

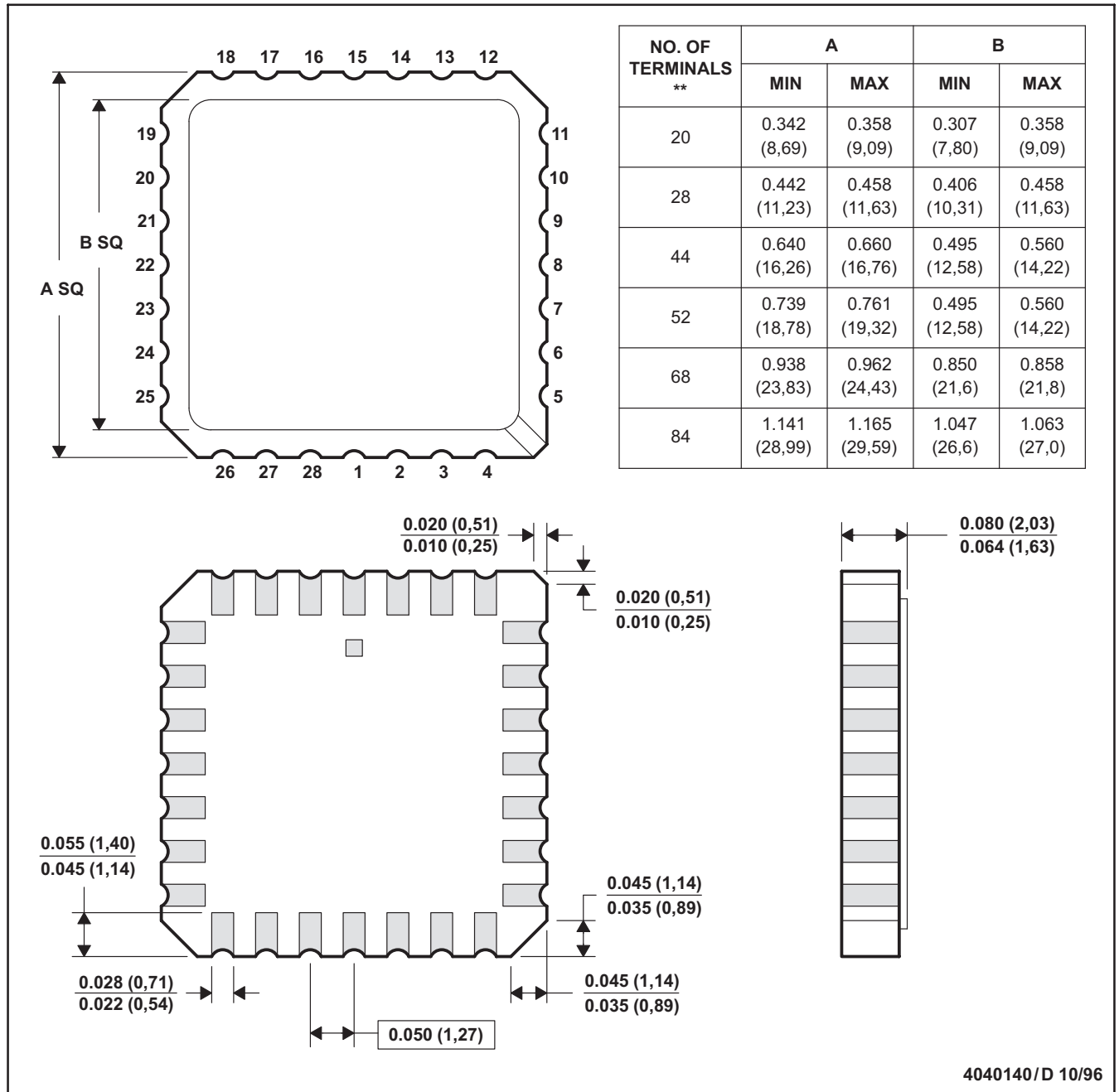


- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only.
 - E. Falls within MIL STD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

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



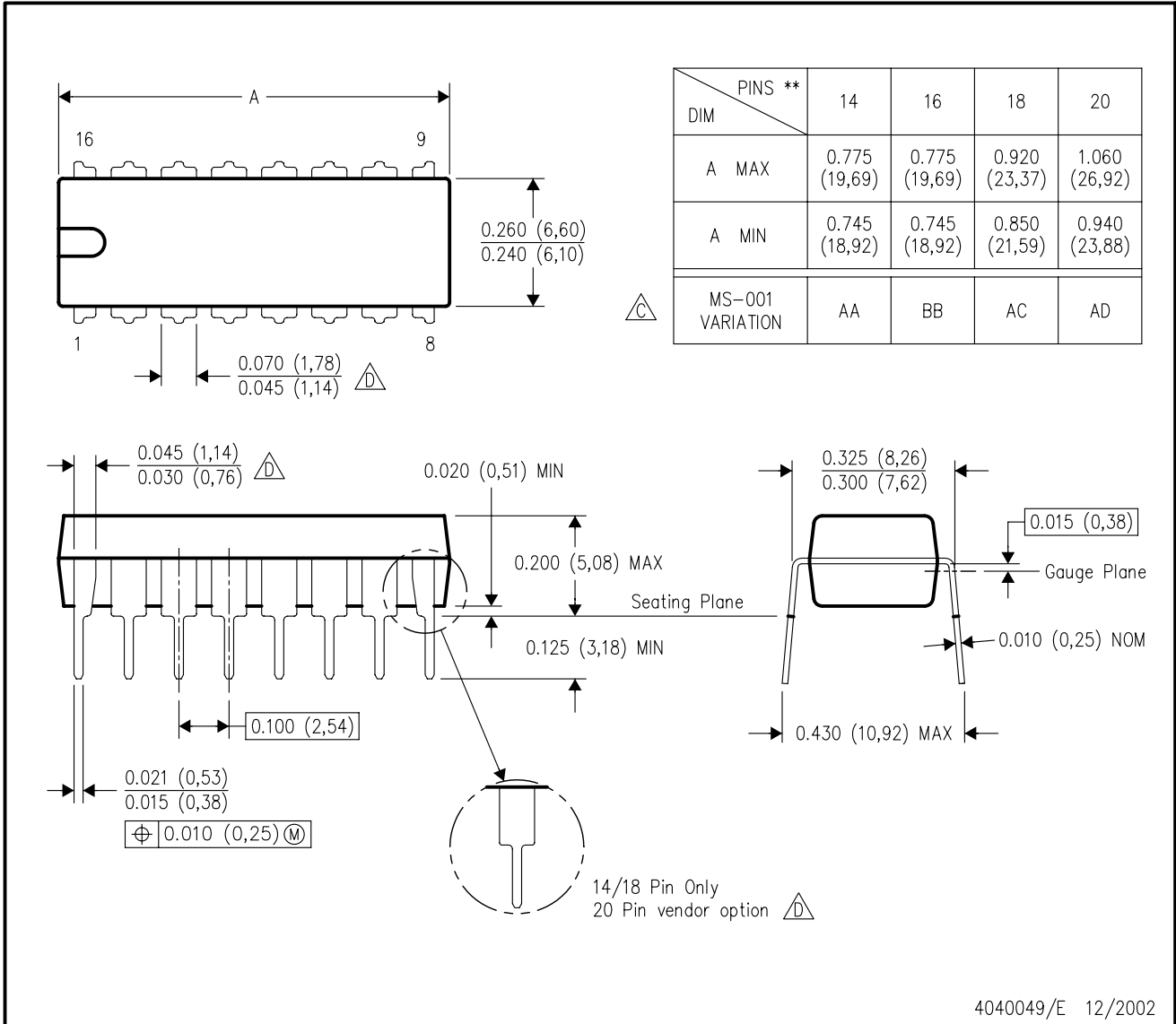
4040140/D 10/96

- 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**)

PLASTIC DUAL-IN-LINE PACKAGE

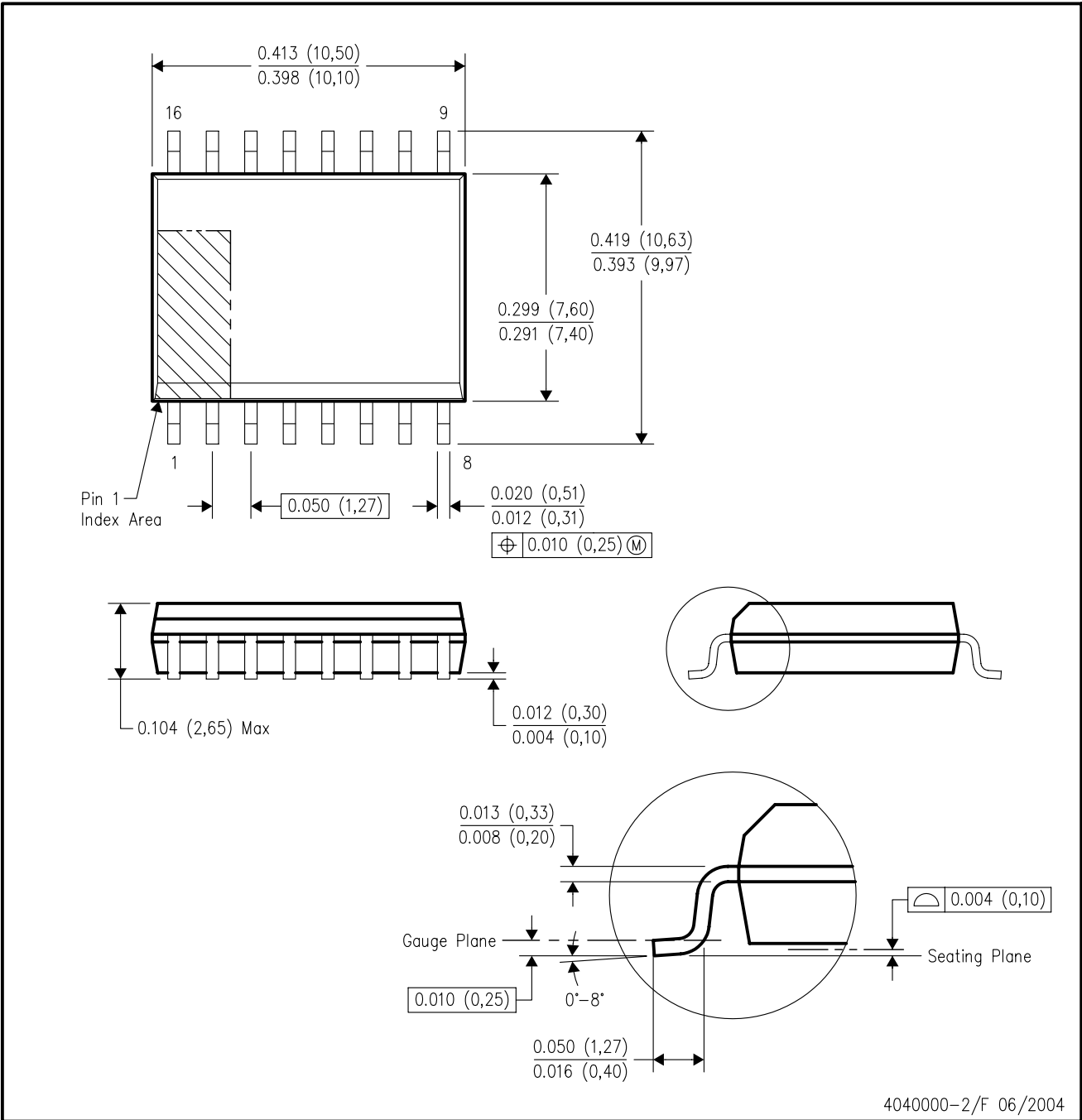
16 PINS SHOWN



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

DW (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-013 variation AA.

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