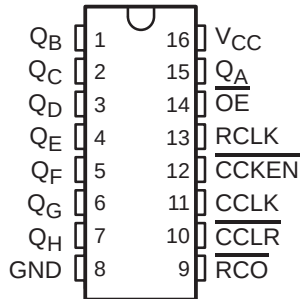


SN54HC590A, SN74HC590A 8-BIT BINARY COUNTERS WITH 3-STATE OUTPUT REGISTERS

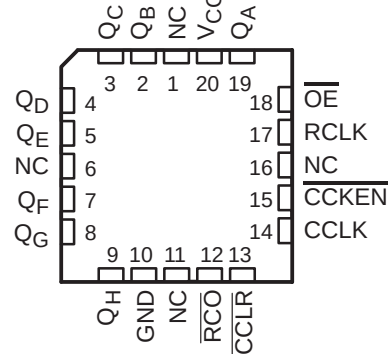
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- 2-V to 6-V V_{CC} Operation
- High-Current 3-State Parallel Register Outputs Can Drive Up To 15 LSTTL Loads
- Low Power Consumption, 80- μ A Max I_{CC}
- Typical $t_{pd} = 14$ ns
- ± 6 -mA Output Drive at 5 V
- Low Input Current of 1 μ A Max
- 8-Bit 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
		Tube of 40	SN74HC590AD	
	SOIC – D	Reel of 2500	SN74HC590ADR	HC590A
		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.



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.

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.



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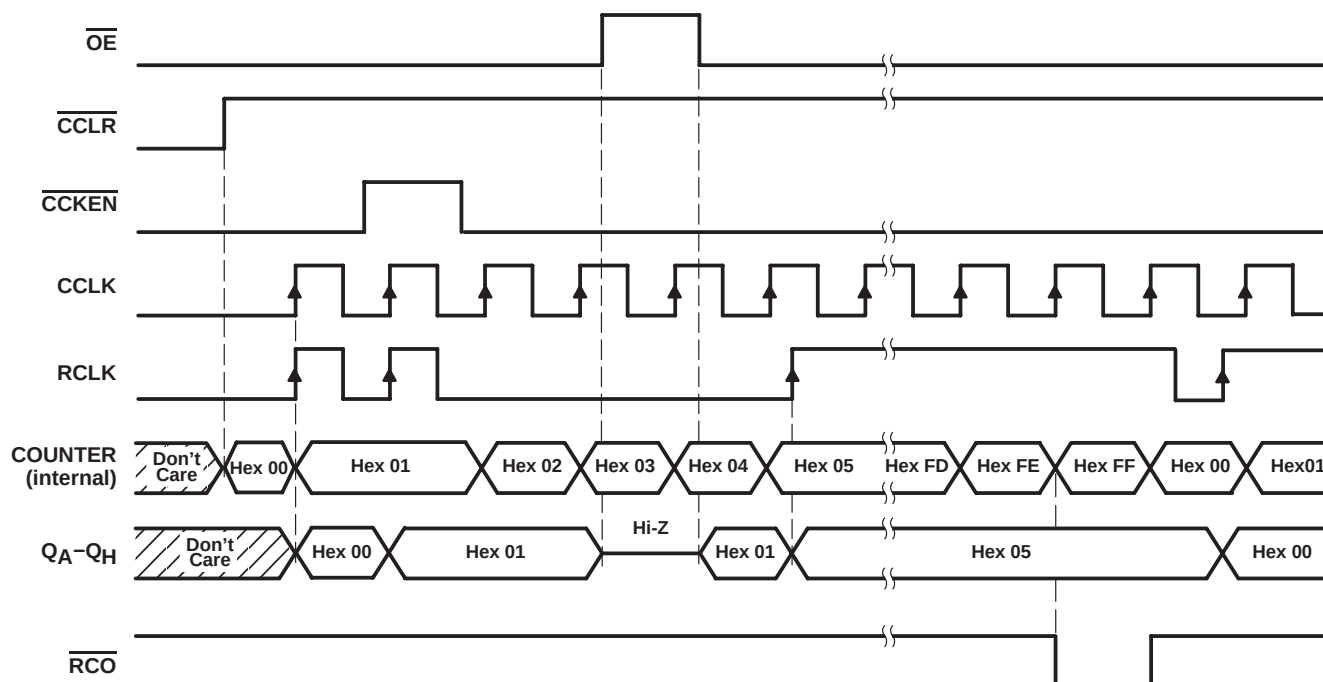
SN54HC590A, SN74HC590A

8-BIT BINARY COUNTERS

WITH 3-STATE OUTPUT REGISTERS

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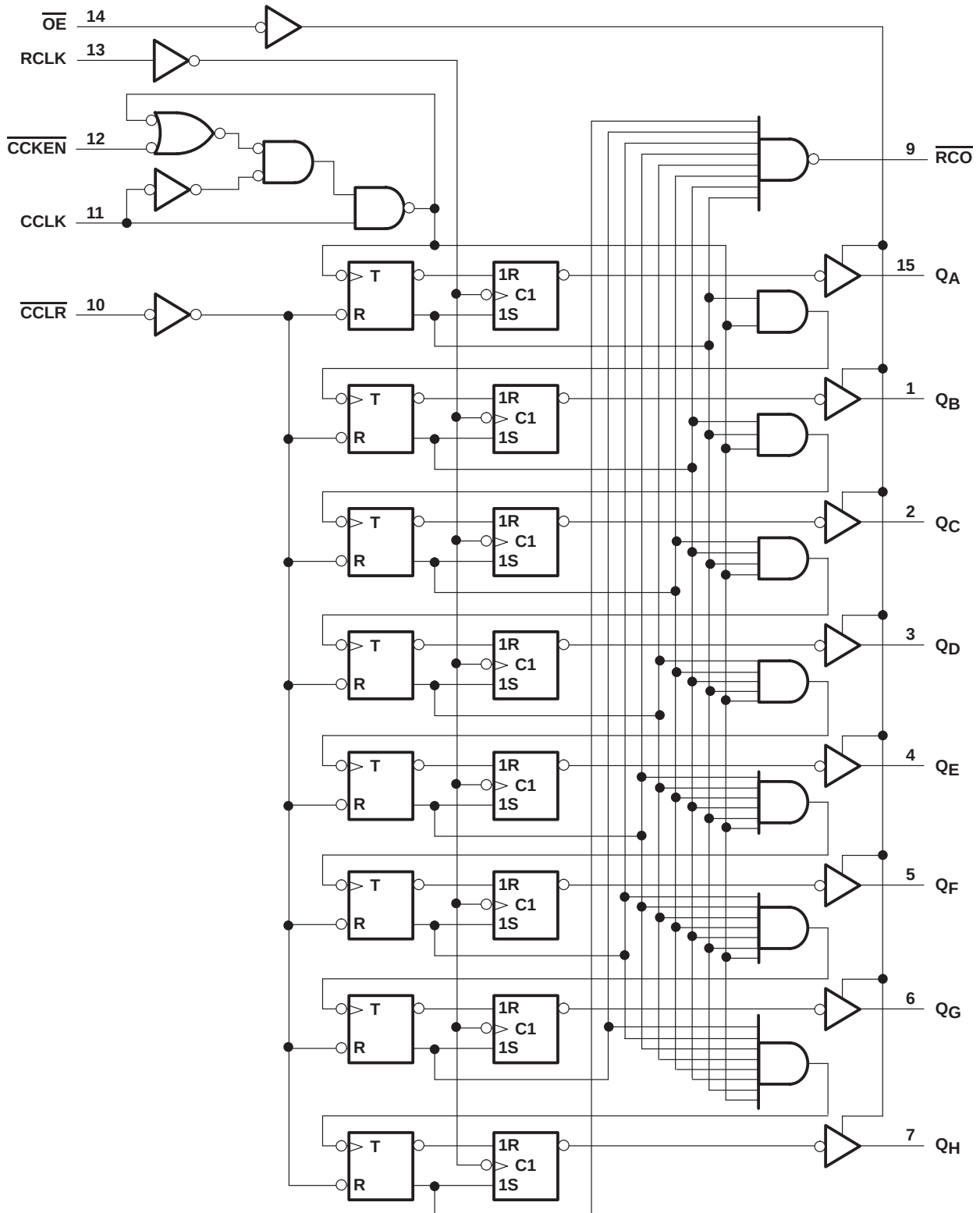
timing diagram



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.

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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})	± 35 mA
Continuous current through V_{CC} or GND	± 70 mA
Package thermal impedance, θ_{JA} (see Note 2): D package	73°C/W
DW package	57°C/W
N package	67°C/W
Storage temperature range, T_{Stg}	-65°C to 150°C

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.

			SN54HC590A			SN74HC590A			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					
t _t [‡]	Input transition (rise and 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.

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		
		$\overline{\text{RCO}}$, I _{OH} = -4 mA	4.5 V	3.98	4.3		3.7		3.84		
		Q _A -Q _H , I _{OH} = -6 mA		3.98	4.3		3.7		3.84		
		$\overline{\text{RCO}}$, I _{OH} = -5.2 mA	6 V	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	
		$\overline{\text{RCO}}$, I _{OL} = 4 mA	4.5 V		0.17	0.26		0.4		0.33	
		Q _A -Q _H , I _{OL} = 6 mA			0.17	0.26		0.4		0.33	
		$\overline{\text{RCO}}$, I _{OL} = 5.2 mA	6 V		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	Pulse duration	2 V	125		200		155		ns
		4.5 V	25		38		31		
		6 V	21		32		26		
	$\overline{\text{CCLR}}$ low	2 V	100		150		125		
		4.5 V	20		30		25		
		6 V	17		26		21		
t _{su}	$\overline{\text{CCKEN}}$ low before CCLK↑	2 V	100		150		125		ns
		4.5 V	20		30		25		
		6 V	17		26		21		
	$\overline{\text{CCLR}}$ 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	$\overline{\text{CCKEN}}$ 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}	$\overline{CCLR}\downarrow$	$\overline{RCO}$	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}	$\overline{OE}\downarrow$	Q	2 V		80	125	185	ns	
			4.5 V		20	30	37		
			6 V		15	28	31		
t _{dis}	$\overline{OE}\uparrow$	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}	$\overline{CCLR}\downarrow$	$\overline{RCO}$	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}	$\overline{OE}\downarrow$	Q	2 V		80	125		155	ns
			4.5 V		20	25		31	
			6 V		15	21		26	
t _{dis}	$\overline{OE}\uparrow$	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, $C_L = 150 \text{ pF}$ (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, $C_L = 150 \text{ pF}$ (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}	$\overline{\text{OE}}$	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, $T_A = 25^\circ\text{C}$

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

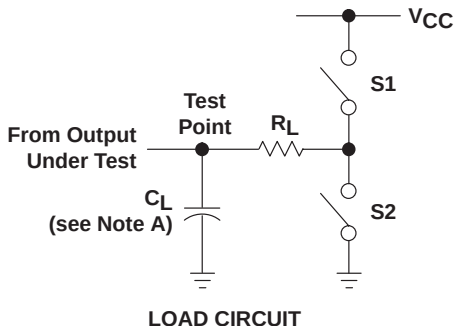
SN54HC590A, SN74HC590A

8-BIT BINARY COUNTERS

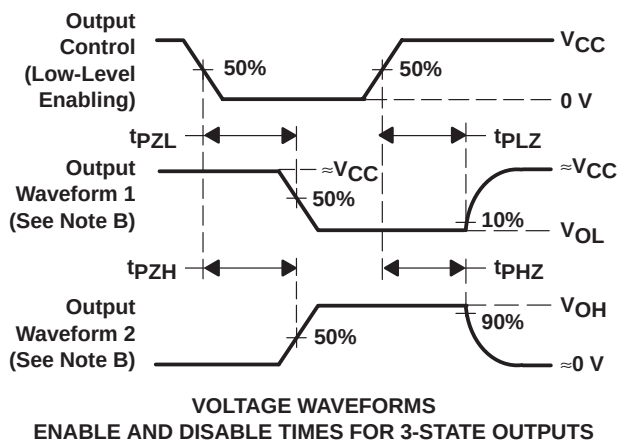
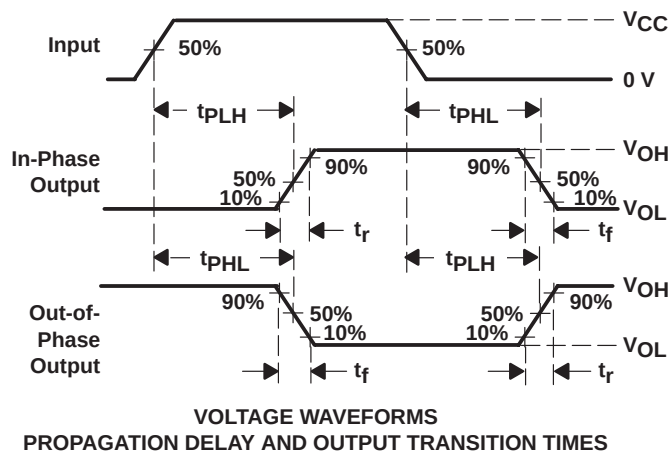
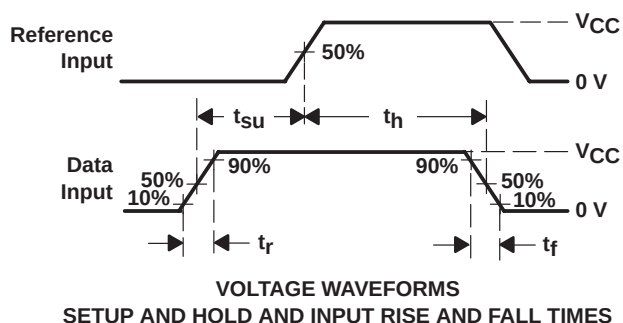
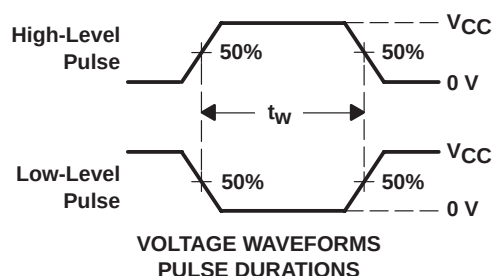
WITH 3-STATE OUTPUT REGISTERS

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PARAMETER MEASUREMENT INFORMATION



PARAMETER	R_L	C_L	S1	S2
t_{en}	1 k Ω	50 pF or 150 pF	Open	Closed
			Closed	Open
t_{dis}	1 k Ω	50 pF	Open	Closed
			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_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - 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⁾
5962-89603012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-8960301EA	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
5962-8960301FA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type
SN54HC590AJ	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
SN74HC590AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC590ADE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC590ADR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC590ADRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC590ADT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC590ADTE4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC590ADW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC590ADWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC590ADWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC590ADWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC590AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74HC590AN3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74HC590ANE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SNJ54HC590AFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54HC590AJ	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54HC590AW	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.

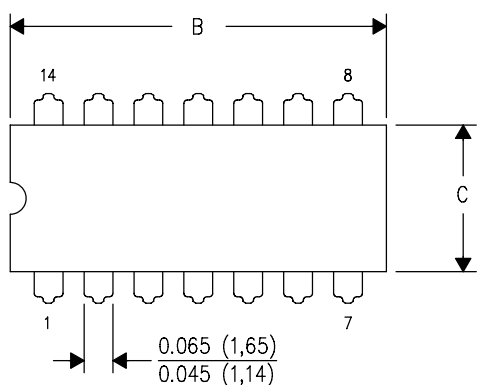
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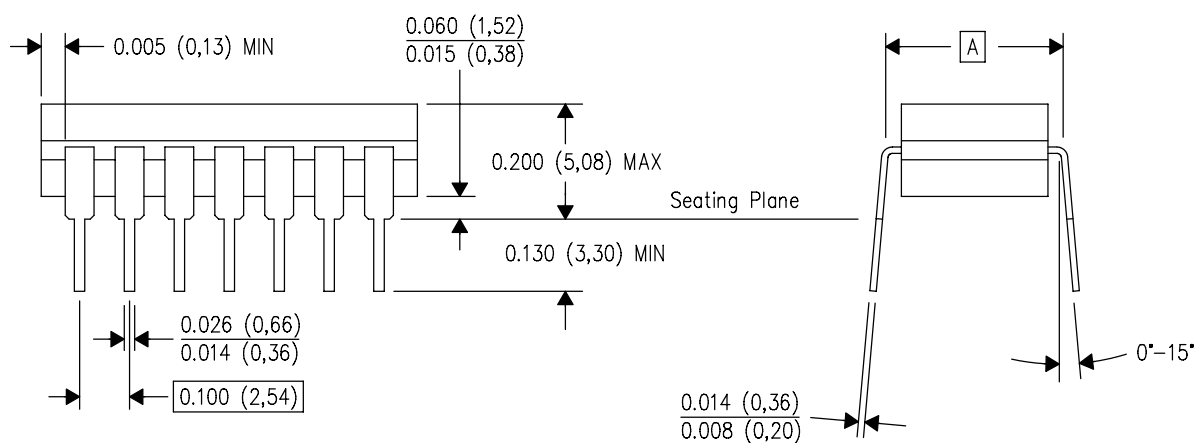
J (R-GDIP-T**)

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)

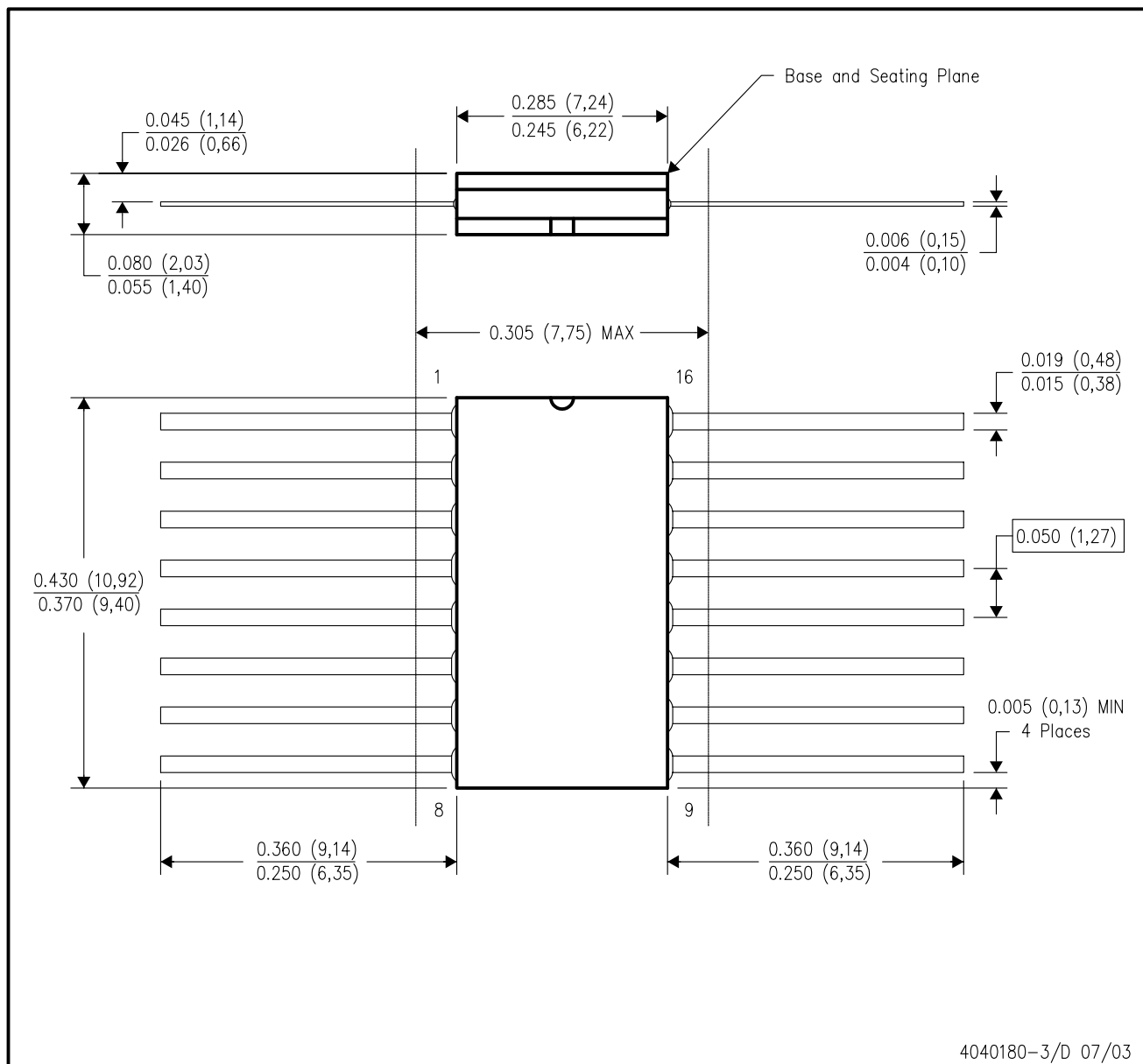


4040083/F 03/03

- 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

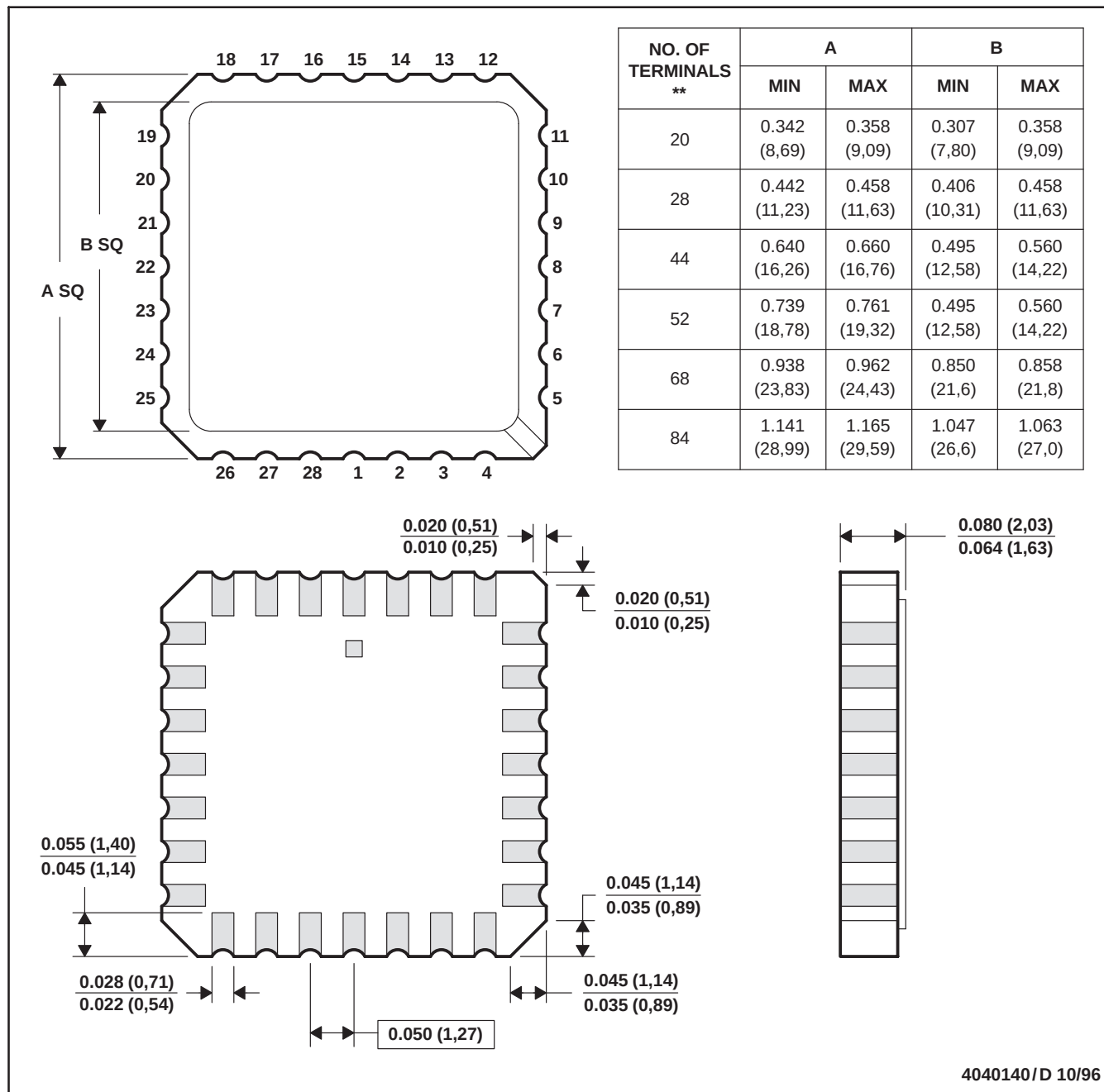


- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only.
 - Falls within MIL STD 1835 GDFP1-F16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

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN

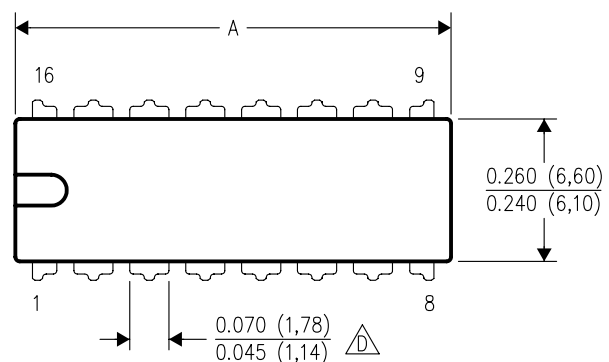


- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - The terminals are gold plated.
 - Falls within JEDEC MS-004

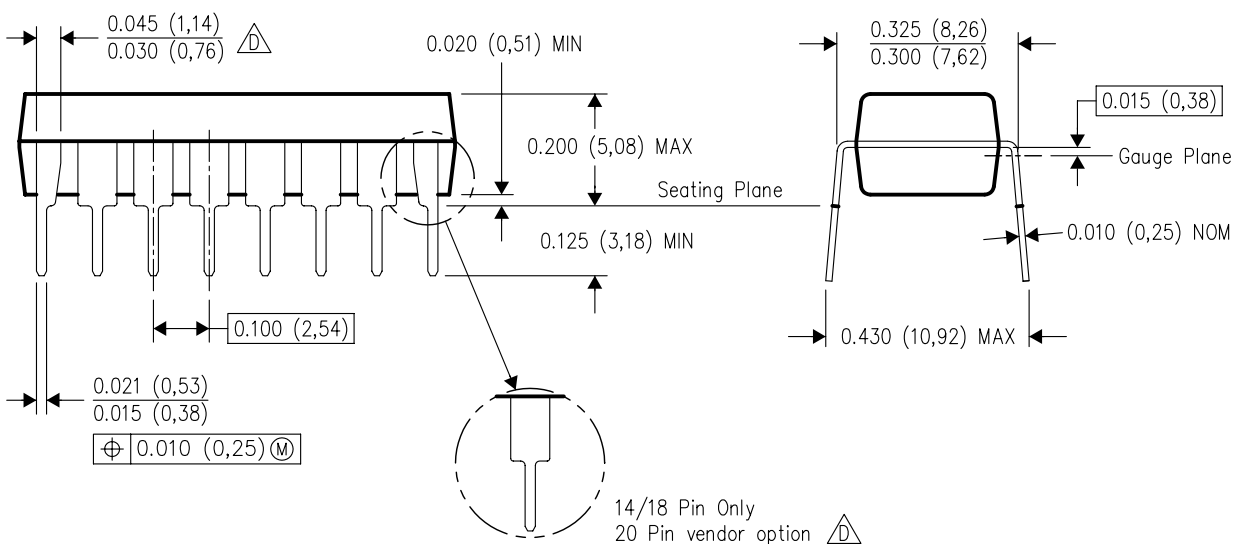
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	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	AA	BB	AC	AD



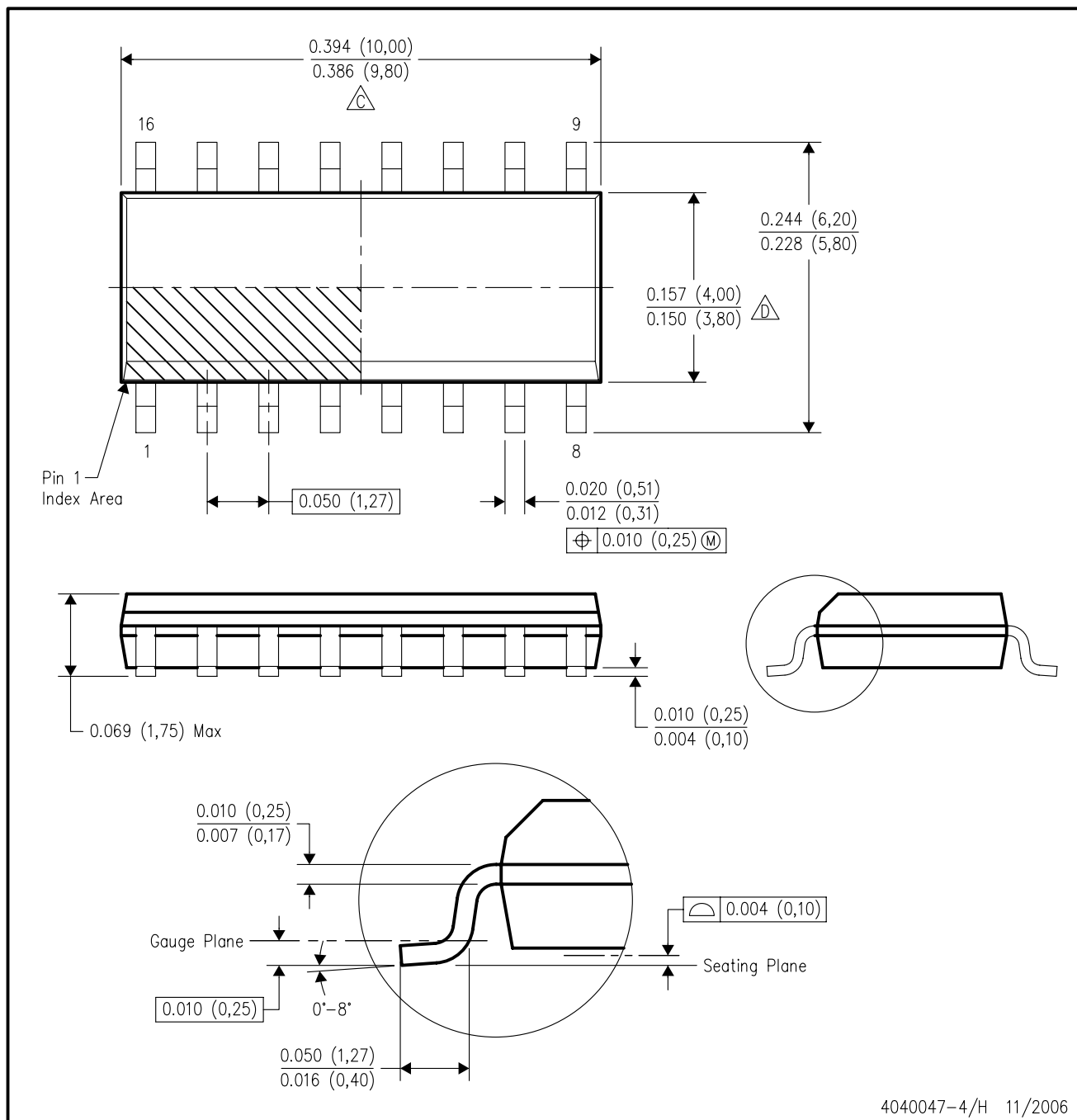
4040049/E 12/2002

NOTES:

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

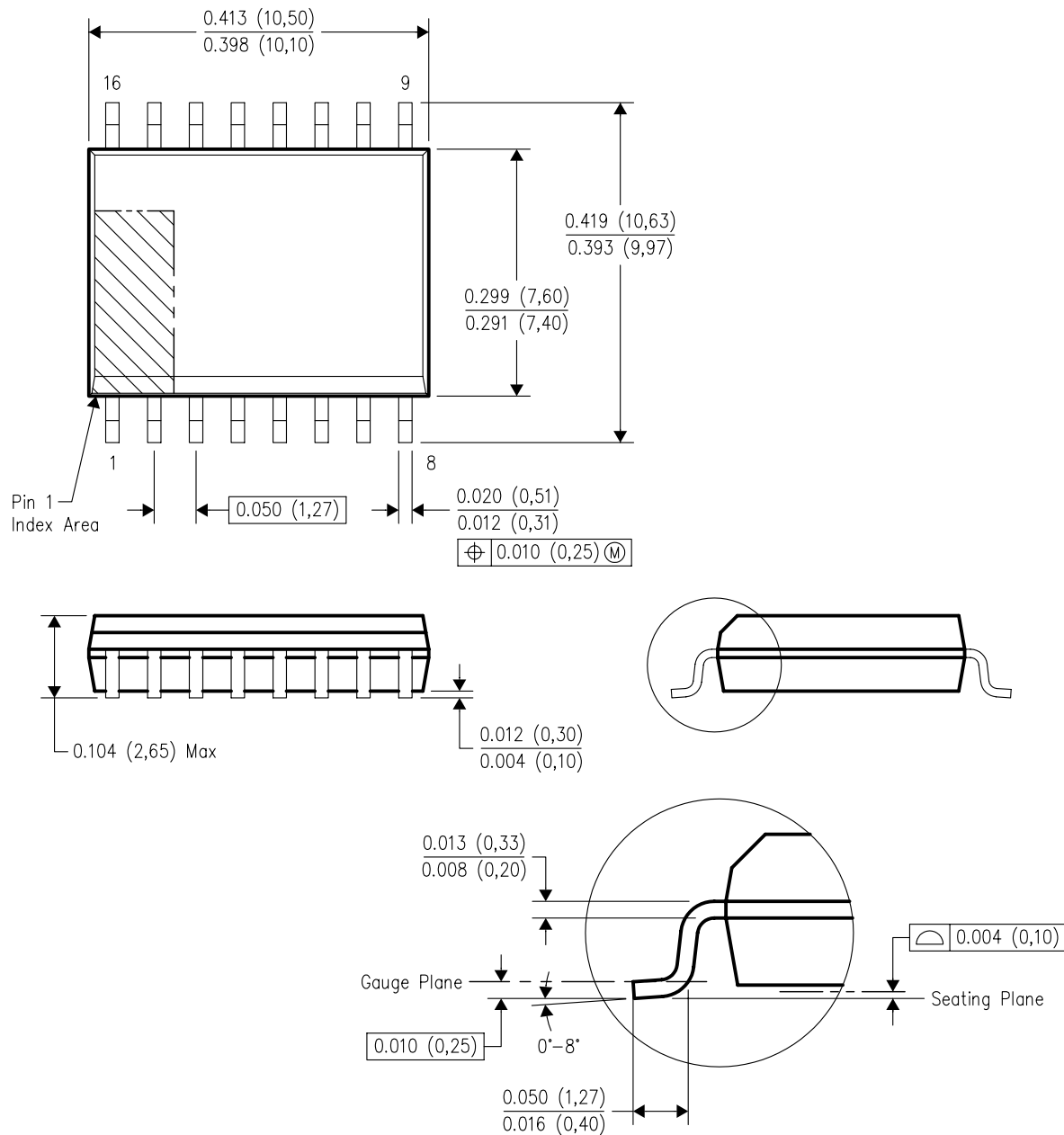


NOTES:

- 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 .006 (0,15) per end.
- D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
- E. Reference JEDEC MS-012 variation AC.

DW (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



4040000-2/F 06/2004

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Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

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