

NE556, SA556, SE556, SE556C DUAL PRECISION TIMERS

SLFS023B – APRIL 1978 – REVISED SEPTEMBER 1997

- Two Precision Timing Circuits per Package
- Astable or Monostable Operation
- TTL-Compatible Output Can Sink or Source Up to 150 mA
- Active Pullup or Pulldown
- Designed to be Interchangeable With Signetics SE556, SE556C, SA556, NE556

applications

Precision Timer From Microseconds to Hours
 Pulse-Shaping Circuit
 Missing-Pulse Detector
 Tone-Burst Generator
 Pulse-Width Modulator
 Pulse-Position Modulator
 Sequential Timer
 Pulse Generator
 Frequency Divider
 Application Timer
 Industrial Controls
 Touch-Tone Encoder

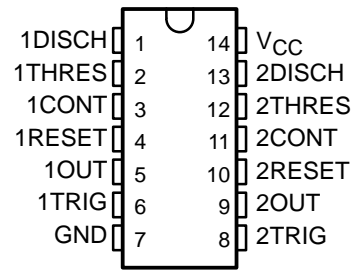
**SE556C FROM TI IS NOT
 RECOMMENDED FOR NEW DESIGNS**

description

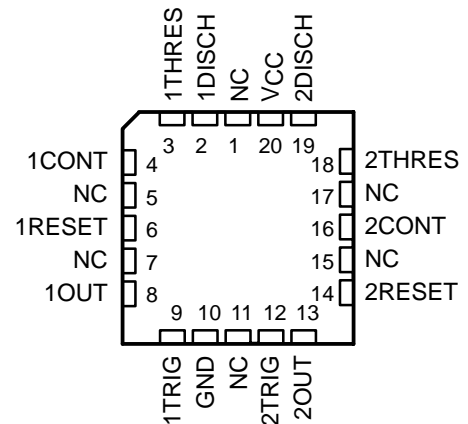
These devices provide two monolithic, independent timing circuits of the NE555, SA555, SE555, or SE555C type in each package. These circuits can be operated in the astable or the monostable mode with external resistor-capacitor timing control. The basic timing provided by the RC time constant may be actively controlled by modulating the bias of the control voltage input.

The threshold and trigger levels are normally two-thirds and one-third respectively of V_{CC} . These levels can be altered by use of the control voltage terminal. When the trigger input falls below trigger level, the flip-flop is set and the output goes high. If the trigger input is above the trigger level and the threshold input is above the threshold level, the flip-flop is reset and the output is low. The reset input can override all other inputs and can be used to initiate a new timing cycle. When the reset input goes low, the flip-flop is reset and the output goes low. Whenever the output is low, a low impedance path is provided between the discharge terminal and ground.

NE556, SA556 . . . D, J, OR N PACKAGE
 SE556, SA556C . . . J PACKAGE
 (TOP VIEW)

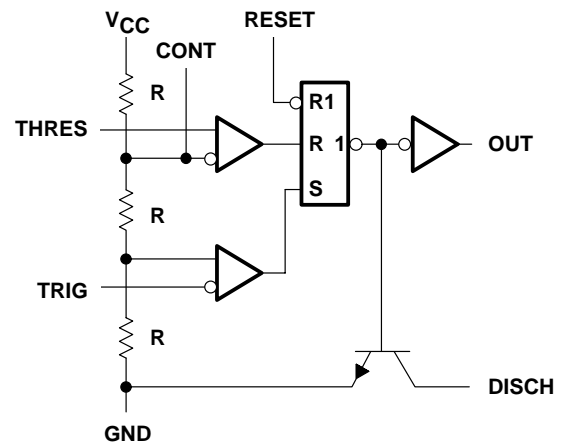


SE556, SE556C . . . FK PACKAGE
 (TOP VIEW)



NC – No internal connection

functional block diagram (each timer)



RESET can override TRIG, which can override THRES.

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description (continued)

The NE556 is characterized for operation from 0°C to 70°C. The SA556 is characterized for operation from –40°C to 85°C, and the SE556 and SE556C are characterized for operation over the full military range of –55°C to 125°C.

AVAILABLE OPTIONS

T _A RANGE	V _{thres max} V _{CC} = 15 V	PACKAGE			
		SMALL OUTLINE (D)	CHIP OUTLINE (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)
0°C to 70°C	11.2 V	NE556D		NE556J	
–40°C to 85°C	11.2 V	SA556D		SA556J	SA556N
–55°C to 125°C	10.6 V 11.2 V		SE556FK SE556CFK		

The D package is available taped and reeled. Add the suffix R to the devicetype (e.g., NE556DR).

FUNCTION TABLE

RESET	TRIGGER VOLTAGE†	THRESHOLD VOLTAGE†	OUTPUT	DISCHARGE SWITCH
Low	Irrelevant	Irrelevant	Low	On
High	< 1/3 V _{DD}	Irrelevant	High	Off
High	> 1/3 V _{DD}	> 2/3 V _{DD}	Low	On
High	> 1/3 V _{DD}	> 2/3 V _{DD}	As previously established	

† Voltage levels shown are nominal.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage, V _{CC} (see Note 1)	18 V
Input voltage (CONT, RESET, THRES, and TRIG)	V _{CC}
Output current	±225 mA
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range: NE556	0°C to 70°C
SA556	–40°C to 85°C
SE556, SE556C	–55°C to 125°C
Storage temperature range	–65°C to 150°C
Case temperature for 60 seconds: FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package	300°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or N package	260°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.

NOTE 1: All voltage values are with respect to network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	T _A ≤ 25°C POWER RATING	DERATING FACTOR ABOVE T _A = 25°C	T _A = 70°C POWER RATING	T _A = 85°C POWER RATING	T _A = 125°C POWER RATING
D	950 mW	7.6 mW/°C	608 mW	494 mW	N/A
FK	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW
J (NE556, SA556)	1025 mW	8.2 mW/°C	656 mW	533 mW	N/A
J (SE556, SE556C)	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW
N	1575 mW	12.6 mW/°C	1008 mW	891 mW	N/A



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recommended operating conditions

	NE556		SA556		SE556		SE556C		UNIT
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Supply voltage, V_{CC}	4.5	16	4.5	16	4.5	18	4.5	16	V
Input voltage (CONT, RESET, THRES, and TRIG), V_I	V_{CC}		V_{CC}		V_{CC}		V_{CC}		V
Output current, I_O	± 200		± 200		± 200		± 200		mA
Operating free-air temperature, T_A	0	70	-40	85	-55	125	-55	125	°C

electrical characteristics, $V_{CC} = 5\text{ V to }15\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	NE556, SA556, SE556C			SE556			UNIT	
		MIN	TYP	MAX	MIN	TYP	MAX		
V_T Threshold voltage level	$V_{CC} = 15\text{ V}$	8.8	10	11.2	9.4	10	10.6	V	
	$V_{CC} = 5\text{ V}$	2.4	3.3	4.2	2.7	3.3	4		
I_T Threshold current (see Note 2)			30	250		30	250	nA	
V_{TRIG} Trigger voltage level	$V_{CC} = 15\text{ V}$	4.5	5	5.6	4.8	5	5.2	V	
	$V_{CC} = 5\text{ V}$	1.1	1.67	2.2	1.45	1.67	1.9		
I_{TRIG} Trigger current	TRIG at 0 V		0.5	2		0.5	0.9	μA	
V_{RESET} Reset voltage level		0.3	0.7	1	0.3	0.7	1	V	
I_{RESET} Reset current	RESET at V_{CC}		0.1	0.4		0.1	0.4	mA	
	RESET at 0 V		-0.4	-1.5		-0.4	-1		
I_{DISCH} Discharge switch off-state current			20	100		20	100	nA	
V_{CONT} Control voltage (open circuit)	$V_{CC} = 15\text{ V}$	9	10	11	9.6	10	10.4	V	
	$V_{CC} = 5\text{ V}$	2.6	3.3	4	2.9	3.3	3.8		
V_{OL} Low-level output voltage	$V_{CC} = 15\text{ V}$	$I_{OL} = 10\text{ mA}$		0.1	0.25		0.1	0.15	V
		$I_{OL} = 50\text{ mA}$		0.4	0.75		0.4	0.5	
		$I_{OL} = 100\text{ mA}$		2	2.5		2	2.2	
		$I_{OL} = 200\text{ mA}$		2.5			2.5		
	$V_{CC} = 5\text{ V}$	$I_{OL} = 5\text{ mA}$		0.1	0.25		0.1	0.15	
		$I_{OL} = 8\text{ mA}$		0.15	0.3		0.15	0.25	
V_{OH} High-level output voltage	$V_{CC} = 15\text{ V}$	$I_{OH} = -100\text{ mA}$	12.75	13.3		13	13.3	V	
		$I_{OH} = -200\text{ mA}$		12.5			12.5		
	$V_{CC} = 5\text{ V}$	$I_{OH} = -100\text{ mA}$	2.75	3.3		3	3.3		
I_{CC} Supply current	Output low, No Load	$V_{CC} = 15\text{ V}$		20	30		20	24	mA
		$V_{CC} = 5\text{ V}$		6	12		6	10	
	Output high, No load	$V_{CC} = 15\text{ V}$		18	26		18	20	nA
		$V_{CC} = 5\text{ V}$		4	10		4	8	

NOTE 2: This parameter influences the maximum value of the timing resistors R_A and R_B in the circuit of Figure 1. For example, when $V_{CC} = 5\text{ V}$, the maximum value is $R = R_A + R_B \approx 3.4\text{ M}\Omega$, and for $V_{CC} = 15\text{ V}$, the maximum value is $\approx 10\text{ M}\Omega$.



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operating characteristics, $V_{CC} = 5\text{ V}$ and 15 V

PARAMETER		TEST CONDITIONS†	NE556, SA556, SE556C			SE556			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Initial error of timing interval‡	Each timer, monostable§	$T_A = 25^\circ\text{C}$	1	3		0.5	1.5		
	Each timer, astable¶		2.25%			1.5%			
	Timer 1 — Timer 2		± 1			± 0.5			
Temperature coefficient of timing interval	Each timer, monostable§	$T_A = \text{MIN to MAX}$	50			30	100	ppm/°C	
	Each timer, astable¶		150			90			
	Timer 1 — Timer 2		± 10			± 10			
Supply voltage sensitivity of timing interval	Each timer, monostable§	$T_A = 25^\circ\text{C}$	0.1	0.5		0.05	0.2	% / V	
	Each timer, astable¶		0.3			0.15			
	Timer 1 — Timer 2		± 0.2			± 0.1			
Output pulse rise time		$C_L = 15\text{ pF}$, $T_A = 25^\circ\text{C}$	100	300		100	200	ns	
Output pulse fall time			100	300		100	200		

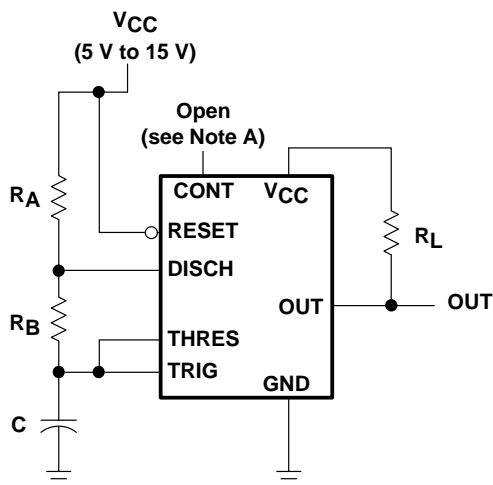
† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ Timing interval error is defined as the difference between the measured value and the average value of a random sample from each process run.

§ Values specified are for a device in a monostable circuit similar to Figure 2, with component values as follow: $R_A = 2\text{ k}\Omega$ to $100\text{ k}\Omega$, $C = 0.1\mu\text{F}$.

¶ Values specified are for a device in an astable circuit similar to Figure 1, with component values as follow: $R_A = 1\text{ k}\Omega$ to $100\text{ k}\Omega$, $C = 0.1\mu\text{F}$.

APPLICATION INFORMATION



NOTE A: Bypassing the control voltage input to ground with a capacitor may improve operation. This should be evaluated for individual applications.

Figure 1. Circuit for Astable Operation

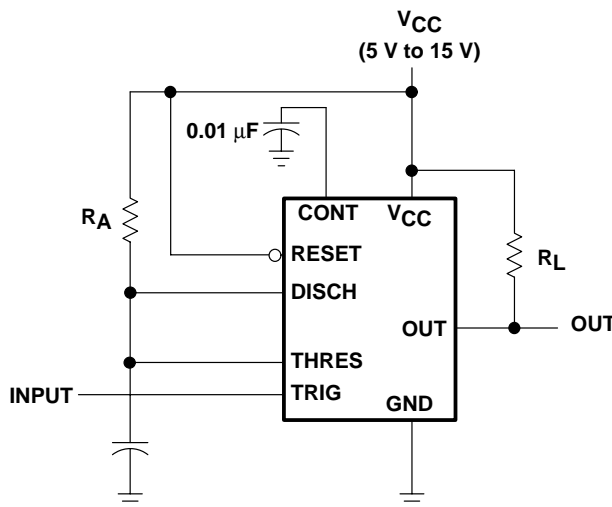


Figure 2. Circuit for Monostable Operation

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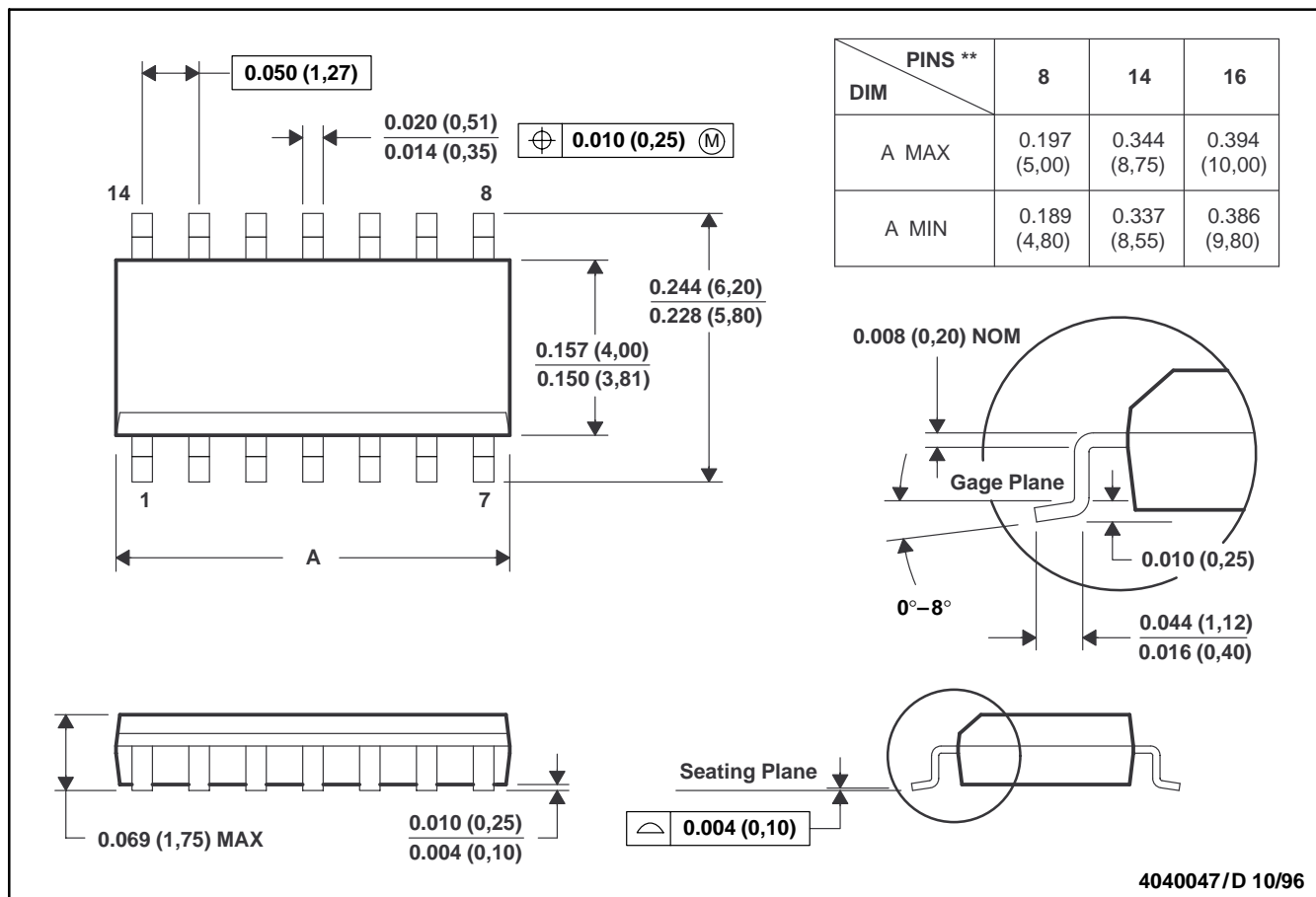
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MECHANICAL INFORMATION

D (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



- 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-012

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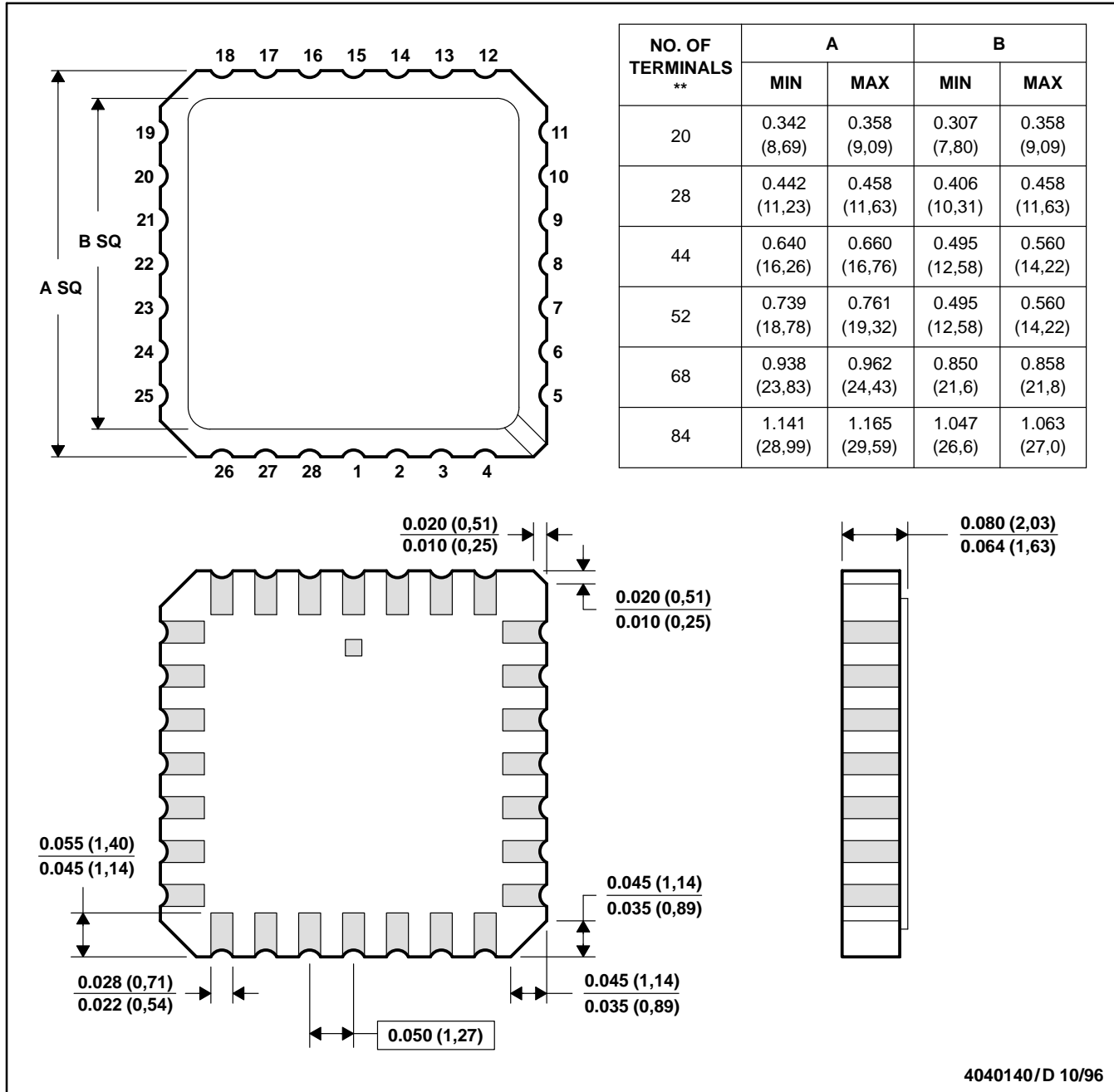
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MECHANICAL INFORMATION

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



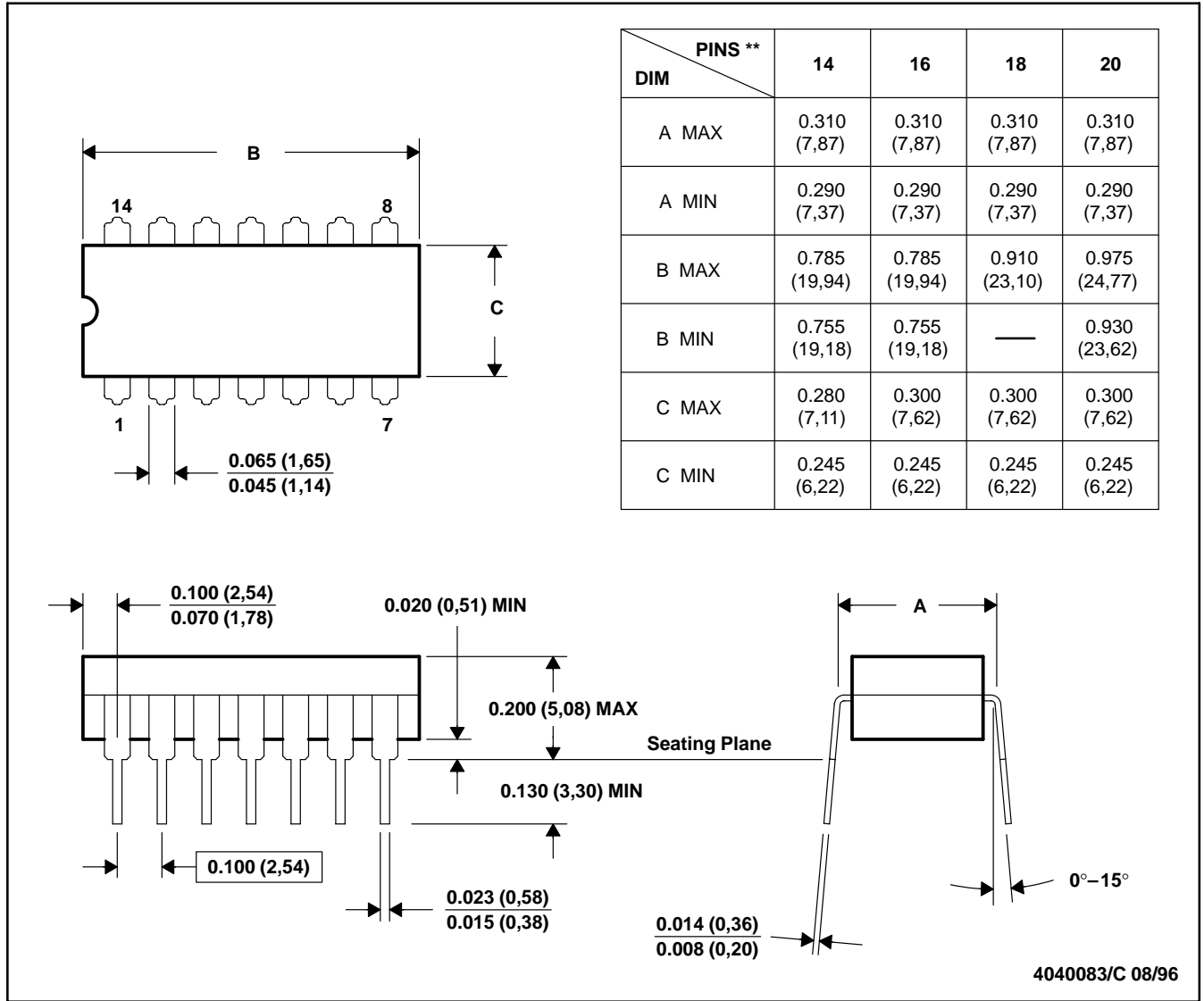
- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a metal lid.
 - D. The terminals are gold plated.
 - E. Falls within JEDEC MS-004

MECHANICAL INFORMATION

J (R-GDIP-T**)

CERAMIC DUAL-IN-LINE PACKAGE

14 PIN 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 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

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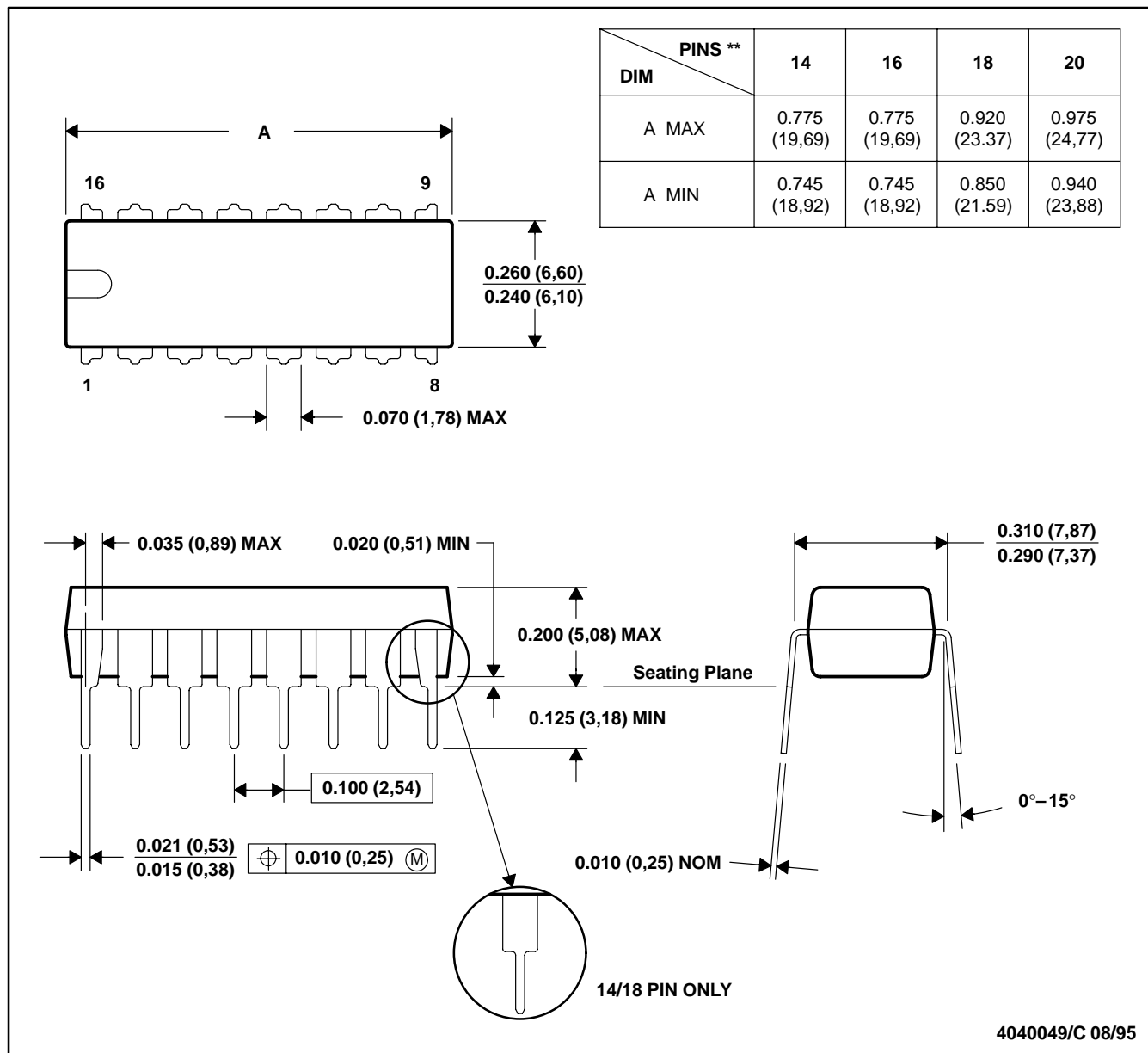
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MECHANICAL INFORMATION

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PIN SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Falls within JEDEC MS-001 (20 pin package is shorter than MS-001.)

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