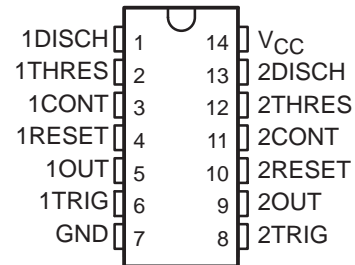


NE556, SA556, SE556 DUAL PRECISION TIMERS

SLFS023F – APRIL 1978 – REVISED MARCH 2003

- 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 NE556, SA556, and SE556
- Applications Include:
 - Precision Timers From Microseconds to Hours
 - Pulse-Shaping Circuits
 - Missing-Pulse Detectors
 - Tone-Burst Generators
 - Pulse-Width Modulators
 - Pulse-Position Modulators
 - Sequential Timers
 - Pulse Generators
 - Frequency Dividers
 - Application Timers
 - Industrial Controls
 - Touch-Tone Encoders

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



description/ordering information

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

The threshold (THRES) and trigger (TRIG) levels normally are two-thirds and one-third, respectively, of V_{CC} . These levels can be altered by using the control-voltage (CONT) 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 (RESET) input can override all other inputs and can be used to initiate a new timing cycle. When RESET goes low, the flip-flop is reset and the output goes low. When the output is low, a low-impedance path is provided between the discharge (DISCH) terminal and ground (GND).

ORDERING INFORMATION

T_A	V_T (MAX) $V_{CC} = 15\text{ V}$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	11.2 V	PDIP (N)	Tube of 25	NE556N	NE556N
		SOIC (D)	Tube of 50	NE556D	NE556
			Reel of 2500	NE556DR	
		SOP (NS)	Reel of 2000	NE556NSR	NE556
-40°C to 85°C	11.2 V	PDIP (N)	Tube of 25	SA556N	SA556N
-55°C to 125°C	10.6 V	CDIP (J)	Tube of 25	SE556J	SE556J
				SE556JB	SE556JB

† 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.

 **TEXAS
INSTRUMENTS**

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NE556, SA556, SE556 DUAL PRECISION TIMERS

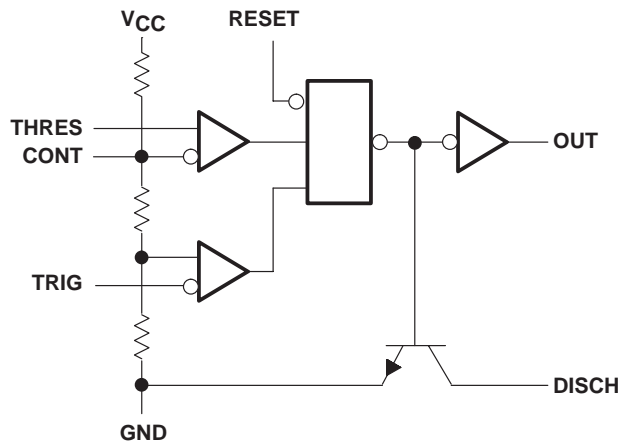
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FUNCTION TABLE
(each timer)

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.

functional block diagram, each timer



RESET can override TRIG, which can override THRES.

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
Package thermal impedance, θ _{JA} (see Notes 2 and 3): D package	86°C/W
N package	80°C/W
NS package	76°C/W
Package thermal impedance, θ _{JC} (see Notes 4 and 5): J package	15.05°C/W
Operating virtual junction temperature, T _J	150°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, N, or NS package	260°C
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. All voltage values are with respect to network ground terminal.

2. Maximum power dissipation is a function of T_{J(max)}, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is P_D = (T_{J(max)} – T_A)/θ_{JA}. Operating at the absolute maximum T_J of 150°C can affect reliability.

3. The package thermal impedance is calculated in accordance with JESD 51-7.

4. Maximum power dissipation is a function of T_{J(max)}, θ_{JC}, and T_C. The maximum allowable power dissipation at any allowable case temperature is P_D = (T_{J(max)} – T_C)/θ_{JC}. Operating at the absolute maximum T_J of 150°C can affect reliability.

5. The package thermal impedance is calculated in accordance with MIL-STD-883.



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NE556, SA556, SE556 DUAL PRECISION TIMERS

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recommended operating conditions

		MIN	MAX	UNIT	
V _{CC}	Supply voltage	NE556, SA556	4.5	16	V
		SE556	4.5	18	
V _I	Input voltage (CONT, RESET, THRES, and TRIG)		V _{CC}	V	
I _O	Output current		±200	mA	
T _A	Operating free-air temperature	NE556	0	70	°C
		SA556	-40	85	
		SE556	-55	125	

NE556, SA556, SE556 DUAL PRECISION TIMERS

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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			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 6)			30	250		30	250	nA	
V_{TRIG} Trigger voltage level	$V_{CC} = 15\text{ V}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	4.5	5	5.6	4.8	5	5.2	V
						3		6	
	$V_{CC} = 5\text{ V}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	1.1	1.67	2.2	1.45	1.67	1.9	
								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	
	$T_A = -55^\circ\text{C to }125^\circ\text{C}$						1.1		
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)	$V_{CC} = 15\text{ V}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	9	10	11	9.6	10	10.4	V
						9.6		10.4	
	$V_{CC} = 5\text{ V}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	2.6	3.3	4	2.9	3.3	3.8	
						2.9		3.8	
V_{OL} Low-level output voltage	$V_{CC} = 15\text{ V}$, $I_{OL} = 10\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	0.1	0.25		0.1	0.15	V	
							0.2		
	$V_{CC} = 15\text{ V}$, $I_{OL} = 50\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	0.4	0.75		0.4	0.5		
							1		
	$V_{CC} = 15\text{ V}$, $I_{OL} = 100\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	2	2.5		2	2.2		
							2.7		
	$V_{CC} = 15\text{ V}$, $I_{OL} = 200\text{ mA}$		2.5			2.5			
	$V_{CC} = 5\text{ V}$, $I_{OL} = 3.5\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$					0.35		
$V_{CC} = 5\text{ V}$, $I_{OL} = 5\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	0.1	0.25		0.1	0.15			
						0.8			
V_{OH} High-level output voltage	$V_{CC} = 15\text{ V}$, $I_{OH} = -100\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	12.75	13.3		13	13.3	V	
						12			
	$V_{CC} = 15\text{ V}$, $I_{OH} = -200\text{ mA}$		12.5			12.5			
	$V_{CC} = 5\text{ V}$, $I_{OH} = -100\text{ mA}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	2.75	3.3		3	3.3		
					2				
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		
		$V_{CC} = 5\text{ V}$	4	10		4	8		

NOTE 6: 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			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		$C_L = 15\text{ pF}, T_A = 25^\circ\text{C}$		100	300		100	200*	ns

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

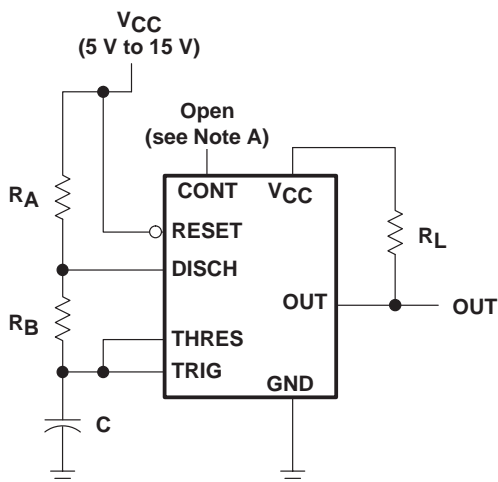
† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ 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 the following component values: $R_A = 2\text{ k}\Omega$ to $100\text{ k}\Omega$, $C = 0.1\text{ }\mu\text{F}$.

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

APPLICATION INFORMATION



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

Figure 1. Circuit for Astable Operation

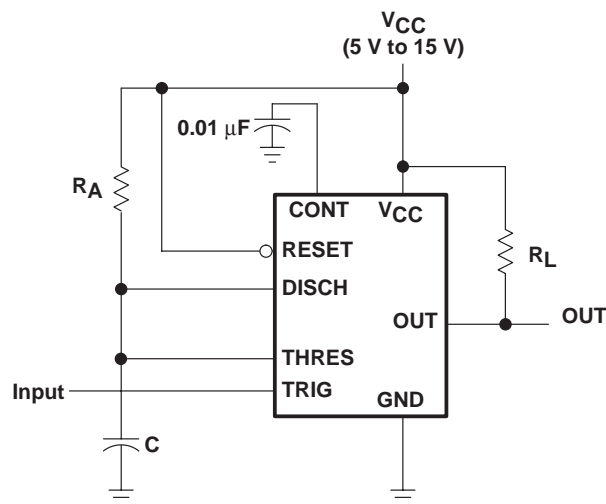


Figure 2. Circuit for Monostable Operation

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
JM38510/10902BCA	ACTIVE	CDIP	J	14	1	None	A42 SNPB	Level-NC-NC-NC
NE556D	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
NE556DBR	ACTIVE	SSOP	DB	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
NE556DR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
NE556N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
NE556NSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SA556D	OBSOLETE	SOIC	D	14		None	Call TI	Call TI
SA556DR	OBSOLETE	SOIC	D	14		None	Call TI	Call TI
SA556N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SE556FKB	OBSOLETE	LCCC	FK	20		None	Call TI	Call TI
SE556J	ACTIVE	CDIP	J	14	1	None	A42 SNPB	Level-NC-NC-NC
SE556JB	ACTIVE	CDIP	J	14	1	None	A42 SNPB	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



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.

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

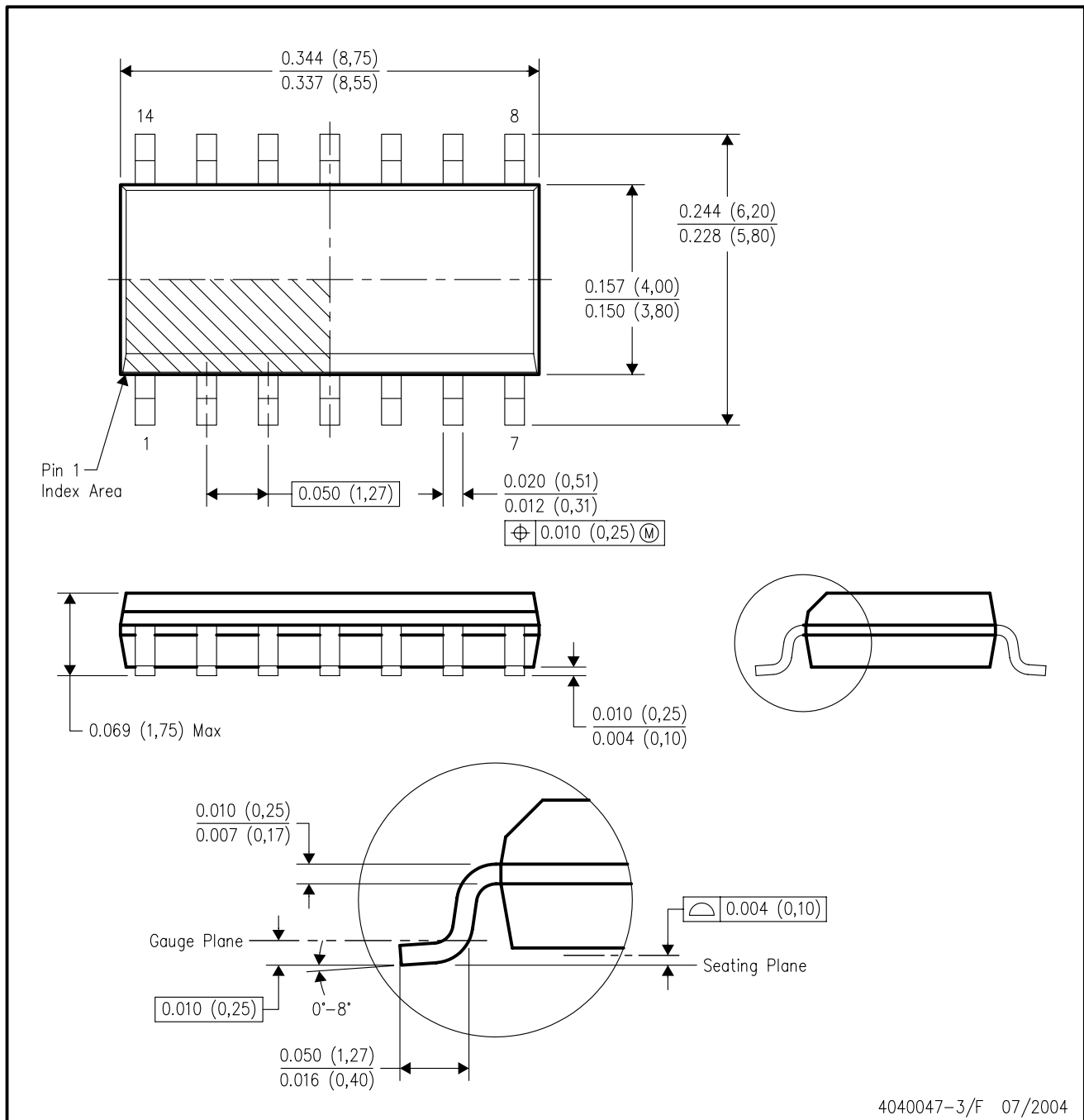


- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - $\triangle C$ Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - $\triangle D$ The 20 pin end lead shoulder width is a vendor option, either half or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

4040049/E 12/2002

D (R-PDSO-G14)

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-012 variation AB.

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.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



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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