

CMOS 8-Bit Addressable Latch

High-Voltage Types (20-Volt Rating)

■ CD4099B 8-bit addressable latch is a serial-input, parallel-output storage register that can perform a variety of functions.

Data are inputted to a particular bit in the latch when that bit is addressed (by means of inputs A0, A1, A2) and when WRITE DISABLE is at a low level. When WRITE DISABLE is high, data entry is inhibited; however, all 8 outputs can be continuously read independent of WRITE DISABLE and address inputs.

A master RESET input is available, which resets all bits to a logic "0" level when RESET and WRITE DISABLE are at a high level. When RESET is at a high level, and WRITE DISABLE is at a low level, the latch acts as a 1-of-8 demultiplexer; the bit that is addressed has an active output which follows the data input, while all unaddressed bits are held to a logic "0" level.

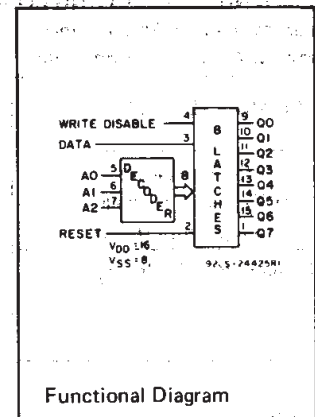
The CD4099B types are supplied in 16-lead hermetic ceramic dual-in-line packages (F3A suffix), 16-lead plastic dual-in-line packages (E suffix), 16-lead small-outline packages (M, M96, MT, and NSR suffixes), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).

Features:

- Serial data input
- Active parallel output
- Storage register capability
- Master clear
- Can function as demultiplexer
- Standardized, symmetrical output characteristics
- 100% tested for quiescent current at 20 V
- Maximum input current of 1 μ A at 18 V (full package-temperature range), 100 nA at 18 V and 25°C
- Noise margin (full package-temperature range) = 1 V at $V_{DD} = 5$ V, 2 V at $V_{DD} = 10$ V, 2.5 V at $V_{DD} = 15$ V
- 5-V, 10-V, and 15-V parametric ratings
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE RANGE, (V_{DD})	-0.5V to +20V
Voltages referenced to V_{SS} Terminal	
INPUT VOLTAGE RANGE, ALL INPUTS	-0.5V to $V_{DD} + 0.5$ V
DC POWER CURRENT, ANY ONE INPUT	± 10 mA
POWER DISSIPATION PER PACKAGE (P_D):	
For $T_A = -55^\circ\text{C}$ to $+100^\circ\text{C}$	500mW
For $T_A = +100^\circ\text{C}$ to $+125^\circ\text{C}$	Derate Linearly at 12mW/ $^\circ\text{C}$ to 200mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR	
FOR $T_A =$ FULL PACKAGE-TEMPERATURE RANGE (All Package Types)	100mW
OPERATING-TEMPERATURE RANGE (T_A)	-55°C to $+125^\circ\text{C}$
STORAGE TEMPERATURE RANGE (T_{stg})	-65°C to $+150^\circ\text{C}$
LEAD TEMPERATURE (DURING SOLDERING):	
At distance 1/16 \pm 1/32 inch (1.59 \pm 0.79mm) from case for 10s max	$+265^\circ\text{C}$



Applications:

- Multi-line decoders
- A/D converters

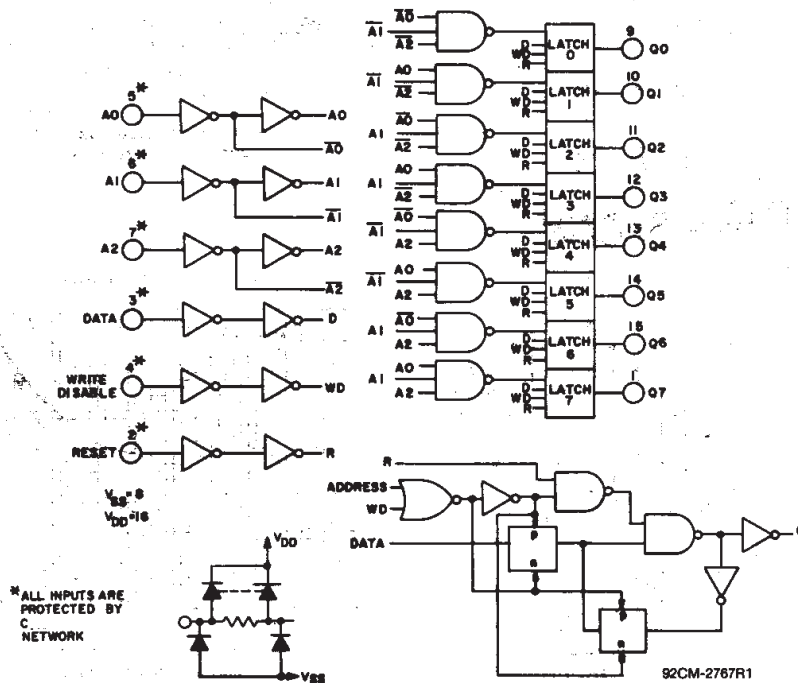


Fig. 1 — Logic diagram of CD4099B and detail of 1 of 8 latches.

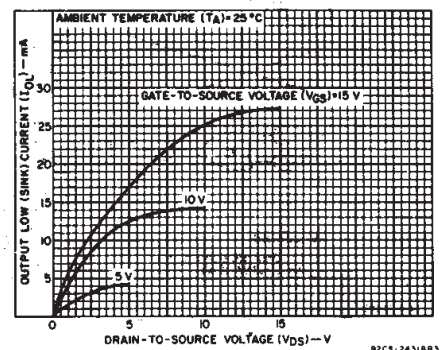
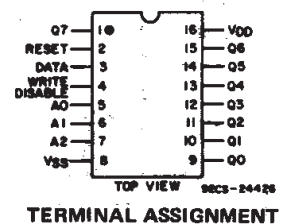


Fig. 2 — Typical output low (sink) current characteristics.

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RECOMMENDED OPERATING CONDITIONS at $T_A = 25^\circ\text{C}$ (Unless otherwise specified)
 For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges.

CHARACTERISTIC	SEE FIG. 15*	V _{DD} (V)	LIMITS		UNITS
			MIN.	MAX.	
Supply Voltage Range: (At T_A = Full Package Temperature Range)			3	18	V
Minimum Pulse Width, t_W Data	4	5	200	—	ns
		10	100	—	
		15	80	—	
Address	8	5	400	—	ns
		10	200	—	
		15	125	—	
Reset	5	5	150	—	ns
		10	75	—	
		15	50	—	
Setup Time, t_S Data to WRITE DISABLE	6	5	100	—	ns
		10	50	—	
		15	35	—	
Hold Time, t_H Data to WRITE DISABLE	7	5	150	—	ns
		10	75	—	
		15	50	—	

* Circled numbers refer to times indicated on master timing diagram.

Note: In addition to the above characteristics, a WRITE DISABLE ON time (the time that WRITE DISABLE is at a high level) must be observed during an address change for the total time that the external address lines A0, A1, and A2 are settling to a stable level, to prevent a wrong cell from being addressed (see Fig. 3).

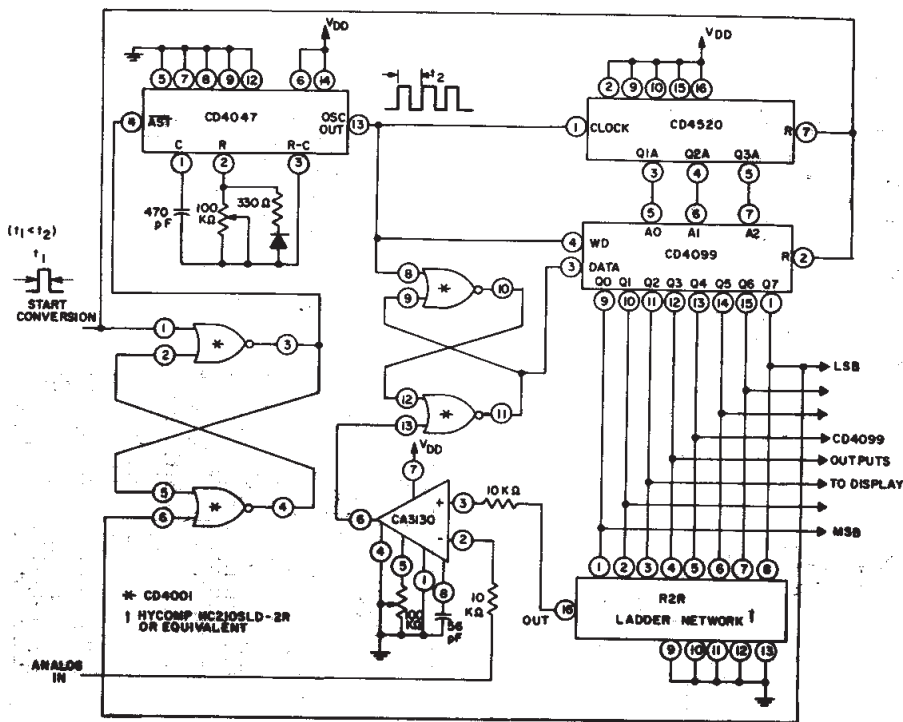


Fig. 5 - A/D converter

92CL-2764

MODE SELECTION			
WD	R	ADDRESSED LATCH	UNADDRESSED LATCH
0	0	Follows Data	Holds Previous State
0	1	Follows Data (Active High 8-Channel Demultiplexer)	Reset to "0"
1	0	Holds Previous State	Reset to "0"
1	1	Reset to "0"	Reset to "0"

WD = WRITE DISABLE

R = RESET

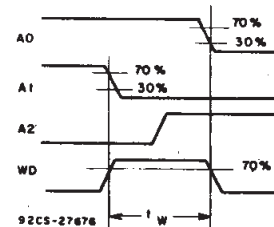


Fig. 3 - Definition of WRITE DISABLE ON time.

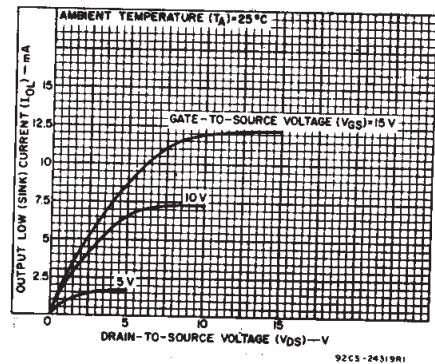


Fig. 4 - Minimum output low (sink) current characteristics.

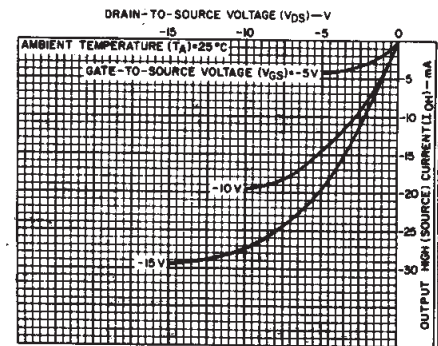
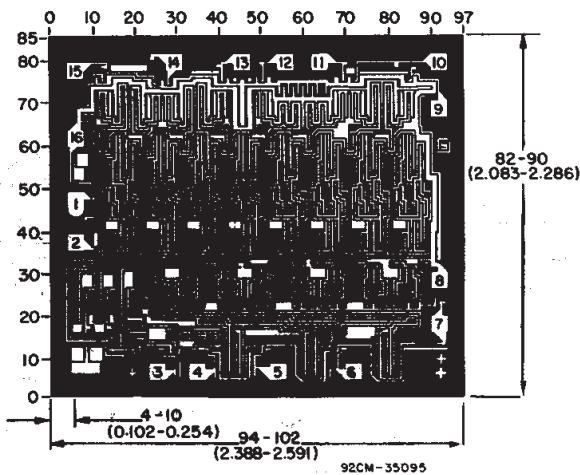


Fig. 6 - Typical output high (source) current characteristics.

CD4099B Types

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
	V _O (V)	V _{IN} (V)	V _{DD} (V)	-55	-40	+85	+125	+25			
								Min.	Typ.	Max.	
Quiescent Device Current, I _{DD} Max.	—	0,5	5	5	5	150	150	—	0,04	5	μA
	—	0,10	10	10	10	300	300	—	0,04	10	
	—	0,15	15	20	20	600	600	—	0,04	20	
	—	0,20	20	100	100	3000	3000	—	0,08	100	
Output Low (Sink) Current I _{OL} Min.	0,4	0,5	5	0,64	0,61	0,42	0,36	0,51	1	—	mA
	0,5	0,10	10	1,6	1,5	1,1	0,9	1,3	2,6	—	
	1,5	0,15	15	4,2	4	2,8	2,4	3,4	6,8	—	
Output High (Source) Current, I _{OH} Min.	4,6	0,5	5	-0,64	-0,61	-0,42	-0,36	-0,51	-1	—	mA
	2,5	0,5	5	-2	-1,8	-1,3	-1,15	-1,6	-3,2	—	
	9,5	0,10	10	-1,6	-1,5	-1,1	-0,9	-1,3	-2,6	—	
Output Voltage: Low-Level, V _{OL} Max.	—	0,5	5	0,05				—	0	0,05	V
	—	0,10	10	0,05				—	0	0,05	
	—	0,15	15	0,05				—	0	0,05	
Output Voltage: High-Level, V _{OH} Min.	—	0,5	5	4,95				4,95	5	—	V
	—	0,10	10	9,95				9,95	10	—	
	—	0,15	15	14,95				14,95	15	—	
Input Low Voltage, V _{IL} Max.	0,5, 4,5	—	5	1,5				—	—	1,5	V
	1, 9	—	10	3				—	—	3	
	1,5, 13,5	—	15	4				—	—	4	
Input High Voltage, V _{IH} Min.	0,5, 4,5	—	5	3,5				3,5	—	—	V
	1, 9	—	10	7				7	—	—	
	1,5, 13,5	—	15	11				11	—	—	
Input Current I _{IN} Max.	—	0,18	18	±0,1	±0,1	±1	±1	—	±10 ⁻⁵	±0,1	μA



CD4099BH
DIMENSIONS AND PAD LAYOUT

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10⁻³ inch).

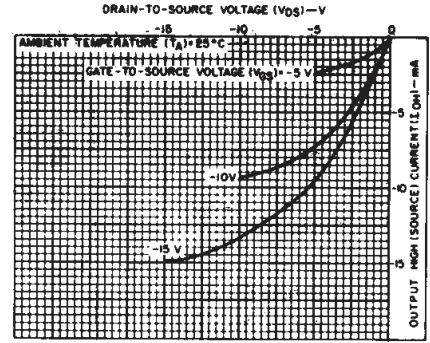


Fig. 7 — Minimum output high (source) current characteristics.

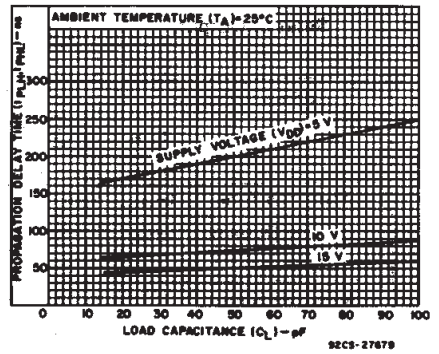


Fig. 8 — Typical propagation delay time (data to Qn) vs. load capacitance.

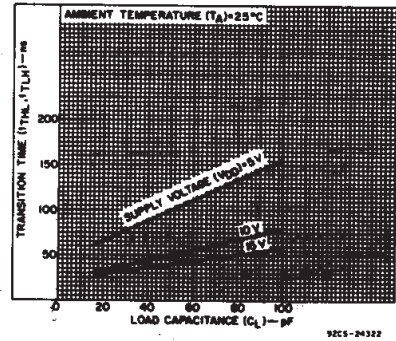


Fig. 9 — Typical transition time vs. load capacitance.

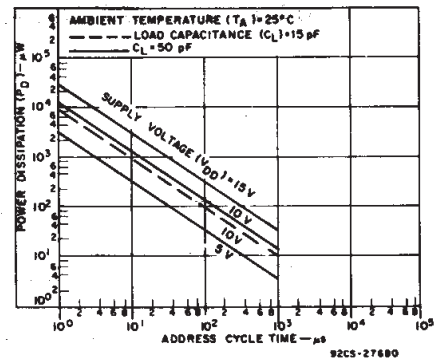


Fig. 10 — Typical dynamic power dissipation vs. address cycle time.

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DYNAMIC ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$,
 Input $t_r, t_f = 20\text{ ns}$, $R_L = 200\text{ K}\Omega$

CHARACTERISTIC	CONDITIONS		LIMITS		UNITS
	SEE	V_{DD} (V)	ALL PACKAGE TYPES		
			TYP.	MAX.	
Propagation Delay: t_{PLH} , t_{PHL}	①	5	200	400	ns
		10	75	150	
		15	50	100	
Data to Output, WRITE DISABLE to Output, t_{PLH} , t_{PHL}	②	5	200	400	
		10	80	160	
		15	60	120	
Reset to Output, t_{PHL}	③	5	175	350	
		10	80	160	
		15	65	130	
Address to Output, t_{PLH} , t_{PHL}	⑨	5	225	450	
		10	100	200	
		15	75	150	
Transition Time, (Any Output) t_{THL} , t_{TLH}		5	100	200	ns
		10	50	100	
		15	40	80	
Minimum Pulse Width, t_W Data	④	5	100	200	ns
		10	50	100	
		15	40	80	
Address	⑧	5	200	400	ns
		10	100	200	
		15	65	125	
Reset	⑤	5	75	150	ns
		10	40	75	
		15	25	50	
Minimum Setup Time, t_S Data to WRITE DISABLE	⑥	5	50	100	ns
		10	25	50	
		15	20	35	
Minimum Hold Time, t_H Data to WRITE DISABLE	⑦	5	75	150	ns
		10	40	75	
		15	25	50	
Input Capacitance, C_{IN}	Any Input		5	7.5	pF

*Circled numbers refer to times indicated on master timing diagram.

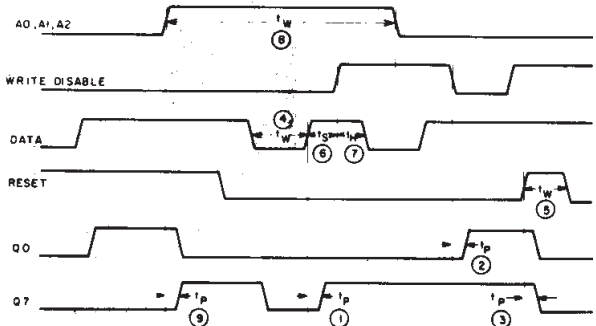


Fig. 15 - Master timing diagram.

92CS-27477

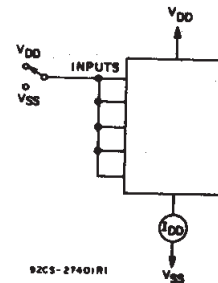


Fig. 11 - Quiescent device current test circuit.

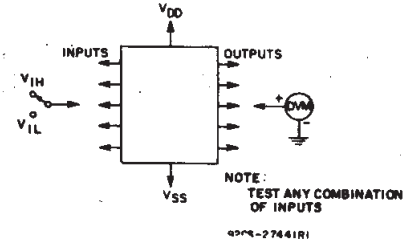


Fig. 12 - Input voltage test circuit.

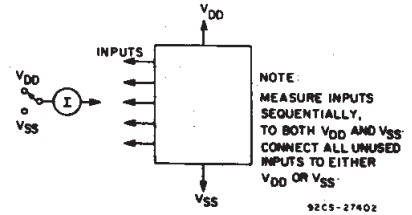


Fig. 13 - Input current test circuit.

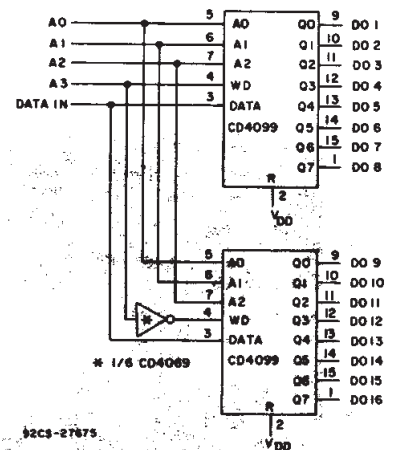


Fig. 14 - 1-of-16 decoder/demultiplexer.

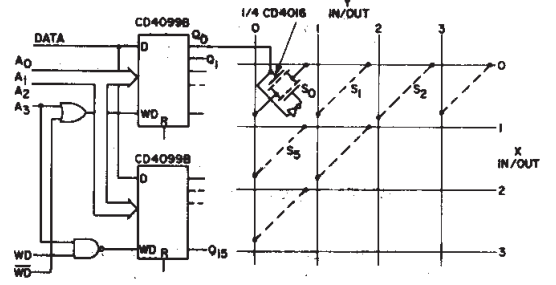


Fig. 16 - Multiple selection decoding - 4 x 4 crosspoint switch.

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
CD4099BE	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD4099BF	ACTIVE	CDIP	J	16	1	None	Call TI	Level-NC-NC-NC
CD4099BF3A	ACTIVE	CDIP	J	16	1	None	Call TI	Level-NC-NC-NC
CD4099BM	ACTIVE	SOIC	D	16	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4099BM96	ACTIVE	SOIC	D	16	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4099BMT	ACTIVE	SOIC	D	16	250	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4099BNSR	ACTIVE	SO	NS	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4099BPW	ACTIVE	TSSOP	PW	16	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4099BPWR	ACTIVE	TSSOP	PW	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
JM38510/17601BEA	ACTIVE	CDIP	J	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



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:
- 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.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

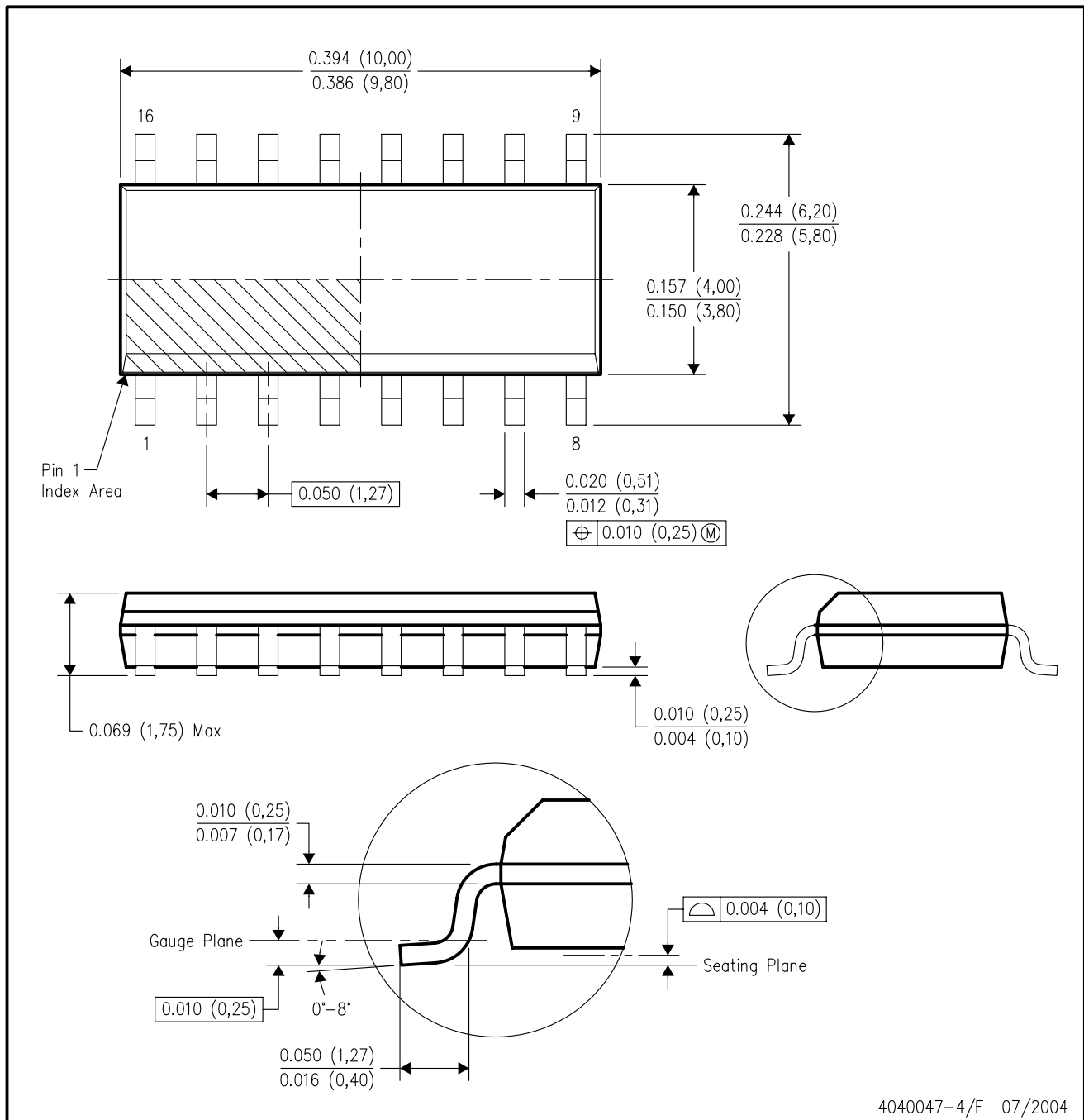
16 PINS SHOWN



- 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 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 AC.

MECHANICAL DATA

NS (R-PDSO-G)**

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

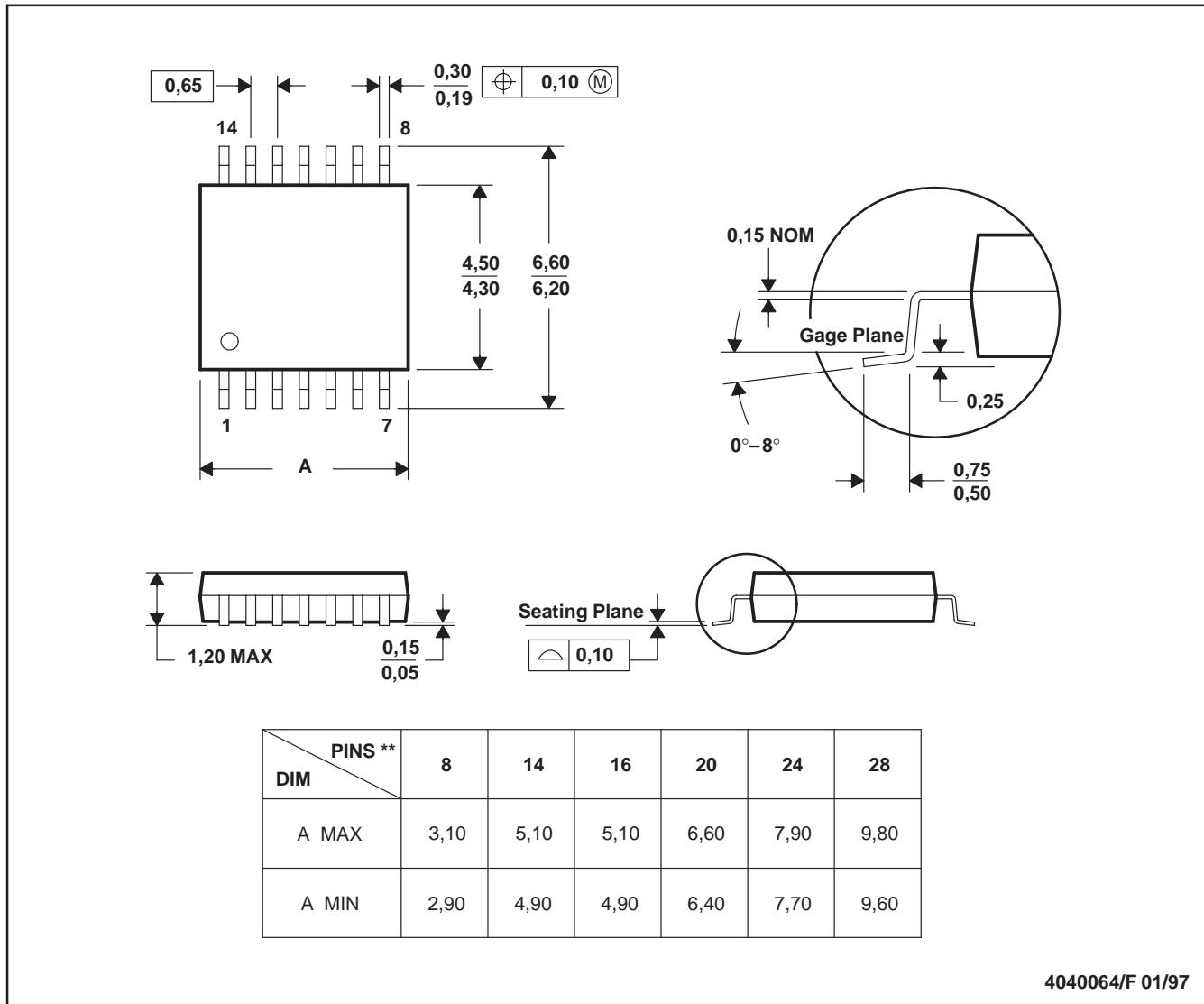


- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- 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-153

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