

CMOS Analog Multiplexers/Demultiplexers

High-Voltage Types (20-Volt Rating)

CD4067B – Single 16-Channel Multiplexer/Demultiplexer

CD4097B – Differential 8-Channel Multiplexer/Demultiplexer

■ CD4067B and CD4097B CMOS analog multiplexers/demultiplexers* are digitally controlled analog switches having low ON impedance, low OFF leakage current, and internal address decoding. In addition, the ON resistance is relatively constant over the full input-signal range.

The CD4067B is a 16-channel multiplexer with four binary control inputs, A, B, C, D, and an inhibit input, arranged so that any combination of the inputs selects one switch.

The CD4097B is a differential 8-channel multiplexer having three binary control inputs A, B, C, and an inhibit input. The inputs permit selection of one of eight pairs of switches.

A logic "1" present at the inhibit input turns all channels off.

The CD4067B and CD4097B types are supplied in 24-lead hermetic dual-in-line ceramic packages (F3A suffix), 24-lead dual-in-line plastic packages (E suffix), 24-lead small-outline packages (M, M96, and NSR suffixes), and 24-lead thin shrink small-outline packages (P and PWR suffixes).

*When these devices are used as demultiplexers, the channel in/out terminals are the outputs and the common out/in terminals are the inputs.

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. Values shown apply to all types except as noted.

Characteristic	Min.	Max.	Units
Supply-Voltage Range (T_A = Full Package-Temp. Range)	3	18	V
Multiplexer Switch Input Current Capability	—	25	mA
Output Load Resistance	100	—	Ω

NOTE:

In certain applications, the external load-resistor current may include both V_{DD} and signal-line components. To avoid drawing V_{DD} current when switch current flows into the transmission gate inputs, the voltage drop across the bidirectional switch must not exceed 0.8 volt (calculated from R_{ON} values shown in ELECTRICAL CHARACTERISTICS CHART). No V_{DD} current will flow through R_L if the switch current flows into terminal 1 on the CD4067; terminals 1 and 17 on the CD4097.

Features:

- Low ON resistance: $125\ \Omega$ (typ.) over 15 V_{p-p} signal-input range for $V_{DD}-V_{SS}=15\ \text{V}$
- High OFF resistance: channel leakage of $\pm 10\ \text{pA}$ (typ.) @ $V_{DD}-V_{SS}=10\ \text{V}$
- Matched switch characteristics: $R_{ON}=5\ \Omega$ (typ.) for $V_{DD}-V_{SS}=15\ \text{V}$
- Very low quiescent power dissipation under all digital-control input and supply conditions: $0.2\ \mu\text{W}$ (typ.) @ $V_{DD}-V_{SS}=10\ \text{V}$
- Binary address decoding on chip
- 5-V, 10-V, and 15-V parametric ratings
- 100% tested for quiescent current at 20 V
- Standardized symmetrical output characteristics
- Maximum input current of $1\ \mu\text{A}$ at 18 V over full package temperature range; $100\ \text{nA}$ at 18 V and 25°C
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

Applications:

- Analog and digital multiplexing and demultiplexing
- A/D and D/A conversion
- Signal gating

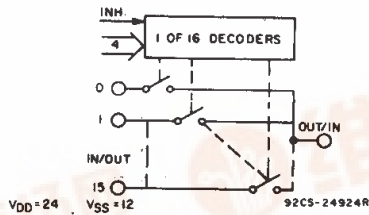


Fig. 1 – CD4067 functional diagram.

CD4067 TRUTH TABLE

A	B	C	D	Inh	Selected Channel
X	X	X	X	1	None
0	0	0	0	0	0
1	0	0	0	0	1
0	1	0	0	0	2
1	1	0	0	0	3
0	0	1	0	0	4
1	0	1	0	0	5
0	1	1	0	0	6
1	1	1	0	0	7
0	0	0	1	0	8
1	0	0	1	0	9
0	1	0	1	0	10
1	1	0	1	0	11
0	0	1	1	0	12
1	0	1	1	0	13
0	1	1	1	0	14
1	1	1	1	0	15

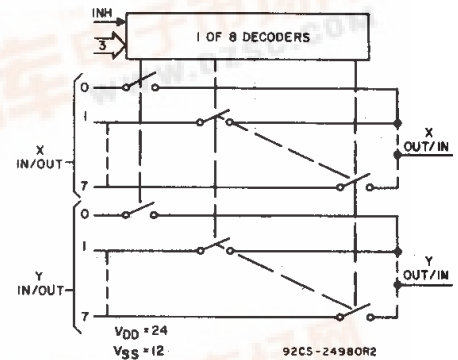
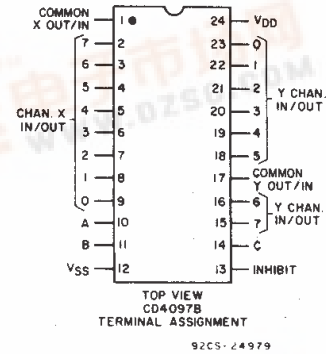
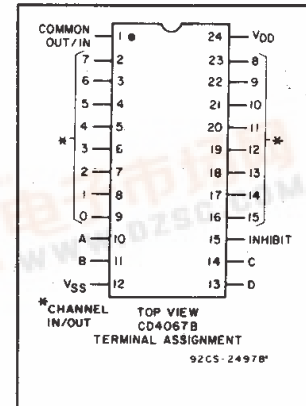


Fig. 2 – CD4097 functional diagram.

CD4097 TRUTH TABLE

A	B	C	Inh	Selected Channel
X	X	X	1	None
0	0	0	0	0X, 0Y
1	0	0	0	1X, 1Y
0	1	0	0	2X, 2Y
1	1	0	0	3X, 3Y
0	0	1	0	4X, 4Y
1	0	1	0	5X, 5Y
0	1	1	0	6X, 6Y
1	1	1	0	7X, 7Y



ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							Units	
	V _{is} (V)	V _{SS} (V)	V _{DD} (V)	-55	-40	+85	+125	+25				
								Min.	Typ.	Max.		
SIGNAL INPUTS (V _{is}) AND OUTPUTS (V _{Os})												
Quiescent Device Current, I _{DD} Max.			5	5	5	150	150	—	0.04	5	μA	
			10	10	10	300	300	—	0.04	10		
			15	20	20	600	600	—	0.04	20		
			20	100	100	3000	3000	—	0.08	100		
ON-state Resistance V _{SS} ≤ V _{is} ≤ V _{DD} r _{on} Max.		0	5	800	850	1200	1300	—	470	1050	Ω	
		0	10	310	330	520	550	—	180	400		
		0	15	200	210	300	320	—	125	240		
Change in on-state Resistance (Between Any Two Channels) Δr _{on}		0	5	—	—	—	—	—	15	—	Ω	
		0	10	—	—	—	—	—	10	—		
		0	15	—	—	—	—	—	5	—		
OFF Channel Leakage Current: Any Channel OFF Max. or All Channels OFF (Common OUT/IN) Max.		0	18	±100*		±1000*		—	±0.1	±100*	nA	
Capacitance: Input, C _{is}		-5	5	—	—	—	—	—	5	—	pF	
Output, C _{os}				—	—	—	—	—	55	—		
CD4067				—	—	—	—	—	35	—		
CD4097				—	—	—	—	—	35	—		
Feed-through, C _{ios}				—	—	—	—	—	0.2	—		
Propagation Delay Time (Signal Input to Output)	V _{DD} 	R _L = 200 KΩ C _L = 50 pF t _r , t _f = 20 ns	5	—	—	—	—	—	30	60	ns	
			10	—	—	—	—	—	15	30		
			15	—	—	—	—	—	10	20		
CONTROL (ADDRESS or INHIBIT) V _C												
Input Low Voltage, V _{IL} Max.	=V _{DD} thru 1 KΩ	R _L = 1 KΩ to V _{SS} I _{IS} ≤ 2 μA on all OFF Channels	5	1.5			—		—		1.5	V
			10	3			—		—		3	
			15	4			—		—		4	
Input High Voltage, V _{IH} Min.			5	3.5			3.5		—		—	
			10	7			7		—		—	
			15	11			11		—		—	

* Determined by minimum feasible leakage measurement for automatic testing.

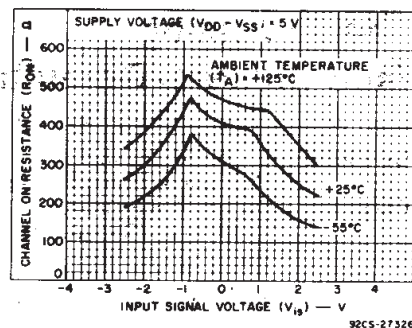


Fig. 3—Typical ON resistance vs. input signal voltage (all types).

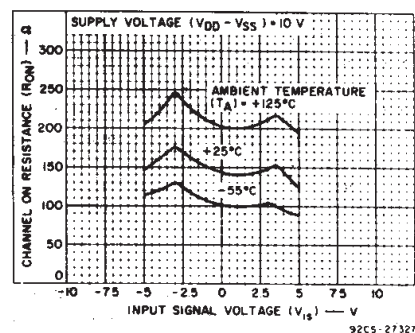


Fig. 4—Typical ON resistance vs. input signal voltage (all types).

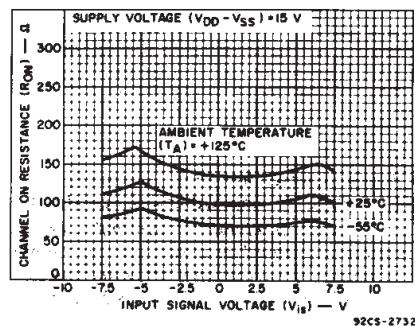


Fig. 5—Typical ON resistance vs. input signal voltage (all types).

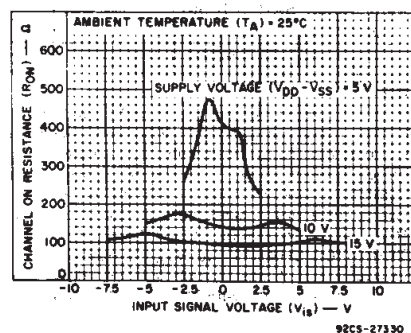


Fig. 6—Typical ON resistance vs. input signal voltage (all types).

ELECTRICAL CHARACTERISTICS (Cont'd)

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							Units
	V _{is} (V)	V _{SS} (V)	V _{DD} (V)	-55	-40	+85	+125	+25			
								Min.	Typ.	Max.	
Input Current, I _{IN} Max.	V _{IN} = 0, 18 V		18	±0.1	±0.1	±1	±1	—	±10 ⁻⁵	±0.1	μA
Propagation Delay Time: Address or Inhibit-to-Signal OUT (Channel turning ON)	R _L = 10 KΩ, C _L = 50 pF, t _r , t _f = 20 ns										ns
	0	5	—	—	—	—	—	325	650		
	0	10	—	—	—	—	—	135	270		
	0	15	—	—	—	—	—	95	190		
Address or Inhibit-to-Signal OUT (Channel turning OFF)	R _L = 300 Ω, C _L = 50 pF, t _r , t _f = 20 ns										ns
	0	5	—	—	—	—	—	220	440		
	0	10	—	—	—	—	—	90	180		
	0	15	—	—	—	—	—	65	130		
Input Capacitance, C _{IN}	Any Address or Inhibit Input			—	—	—	—	—	5	7.5	pF

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE RANGE, (V_{DD})

Voltages referenced to V_{SS} Terminal) -0.5V to +20V

INPUT VOLTAGE RANGE, ALL INPUTS -0.5V to $V_{DD} + 0.5\text{V}$

DC INPUT CURRENT, ANY ONE INPUT $\pm 10\text{mA}$

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 $12\text{mW}/^\circ\text{C}$ to 200mW

DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR $T_A = \text{FULL PACKAGE-TEMPERATURE RANGE (All Package Types)}$ 100mW

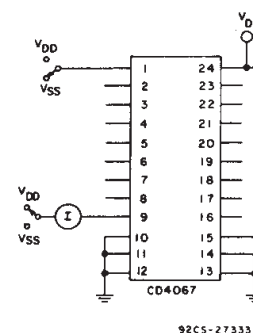
OPERATING-TEMPERATURE RANGE (T_A) -55°C to $+125^\circ\text{C}$

STORAGE TEMPERATURE RANGE (T_{stg}) -65°C to $+150^\circ\text{C}$

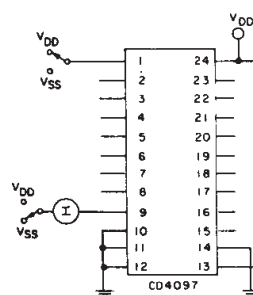
LEAD TEMPERATURE (DURING SOLDERING):

At distance $1/16 \pm 1/32$ inch ($1.59 \pm 0.79\text{mm}$) from case for 10s max $+265^\circ\text{C}$

TEST CIRCUITS

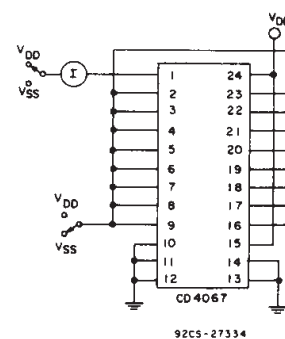


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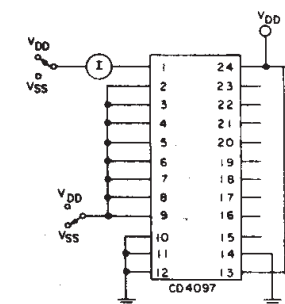


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Fig. 7—OFF channel leakage current—any channel OFF.

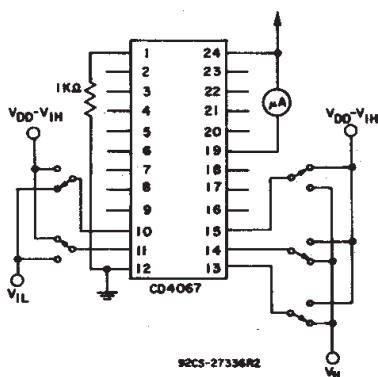


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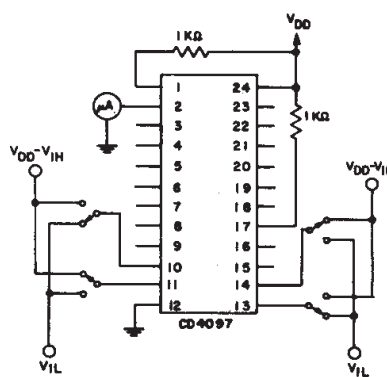


92CS-27335

Fig. 9—OFF channel leakage current—all channels OFF.



92CS-27334R2



92CS-27337R2

Fig. 8—Input voltage—measure $< 2\ \mu\text{A}$ on all OFF channels (e.g., channel 12).

CD4067B, CD4097B Types

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ELECTRICAL CHARACTERISTICS (Cont'd)

CHARAC- TERISTIC	TEST CONDITIONS			TYPICAL VALUES	UNITS	
	V _{is} (V)	V _{DD} (V)	R _L (KΩ)			
Cutoff (-3-dB) Frequency Channel ON (Sine Wave Input)	5 [●]	10	1			
	$20 \log \frac{V_{os}}{V_{is}} = -3 \text{ dB}$			V _{os} at Common OUT/IN	CD4067	14
					CD4097	20
				V _{os} at Any Channel		60
Total Harmonic Distortion, THD	2 [●]	5	10			0.3
	3 [●]	10				0.2
	5 [●]	15				0.12
	f _{is} = 1 kHz sine wave					
-40-dB Feedthrough Frequency (All Channels OFF)	5 [●]	10	1			
	$20 \log \frac{V_{os}}{V_{is}} = -40 \text{ dB}$			V _{os} at Common OUT/IN	CD4067	20
					CD4097	12
				V _{os} at Any Channel		8
Signal Cross- talk (Fre- quency at -40 dB)	5 [●]	10	1	Between Any 2 Channels [▲]		1
	$20 \log \frac{V_{os}}{V_{is}} = -40 \text{ dB}$					Between Sections CD4097 Only
					Measured on Any Channel	18
	Address-or- Inhibit-to- Signal Crosstalk	—	10	10*		
V _{SS} =0, t _r , t _f =20 ns, V _C =V _{DD} -V _{SS} (Square Wave)						
						mV (Peak)

● Peak-to-peak voltage symmetrical about $\frac{V_{DD}-V_{SS}}{2}$.

▲ Worst case.

* Both ends of channel.

TEST CIRCUITS (Cont'd)

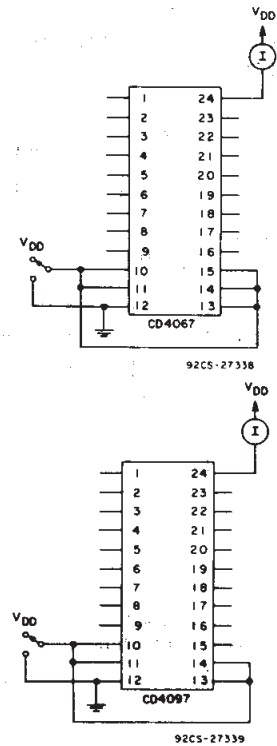


Fig. 10—Quiescent device current.

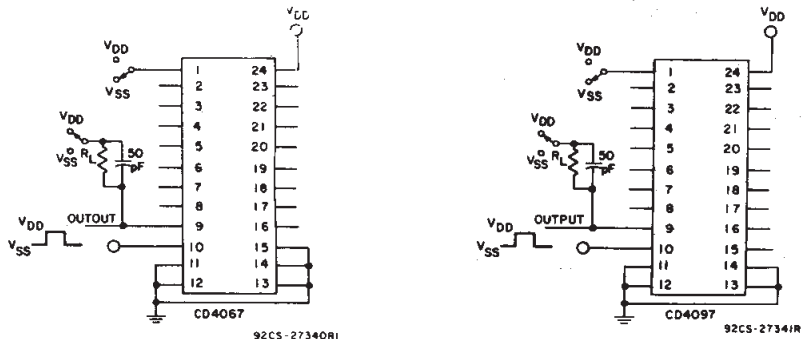


Fig. 11—Turn-on and turn-off propagation delay—address select input to signal output (e.g. measured on channel 0).

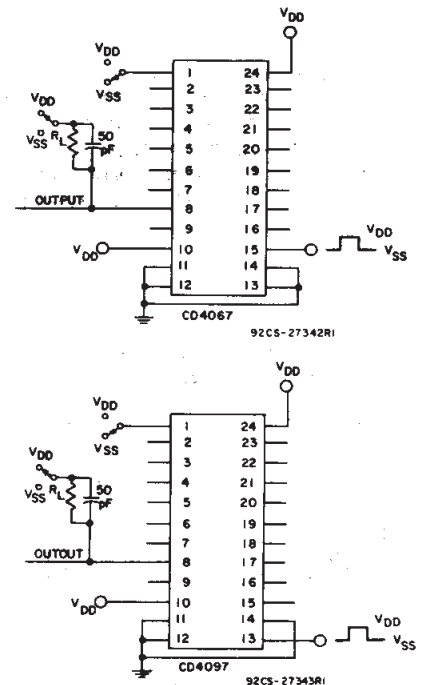


Fig. 12—Turn-on and turn-off propagation delay—
inhibit input to signal output (e.g. measured on channel 1).

CD4067B, CD4097B Types

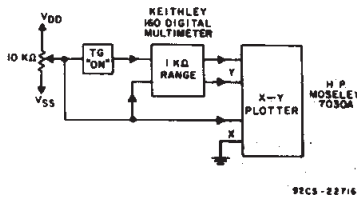


Fig. 13- Channel ON resistance measurement circuit.

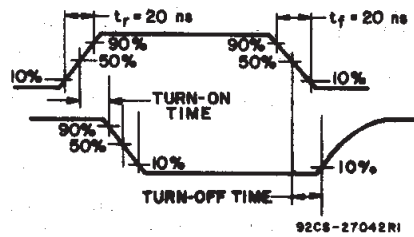


Fig. 14- Propagation delay waveform channel being turned ON ($R_L = 10\text{ K}\Omega$, $C_L = 50\text{ pF}$).

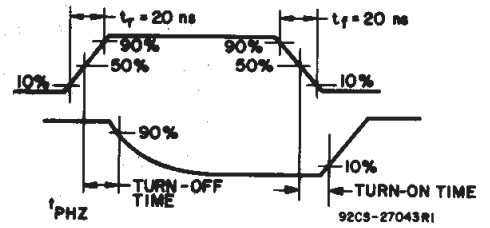


Fig. 15- Propagation delay waveform, channel being turned OFF ($R_L = 300\Omega$, $C_L = 50\text{ pF}$).

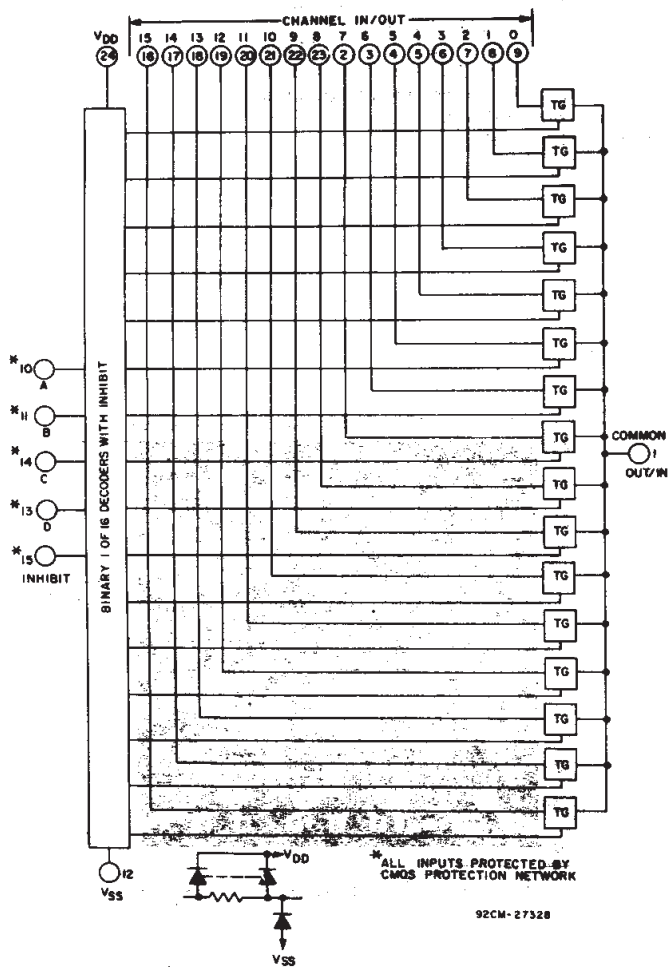


Fig. 16- CD4067 logic diagram.

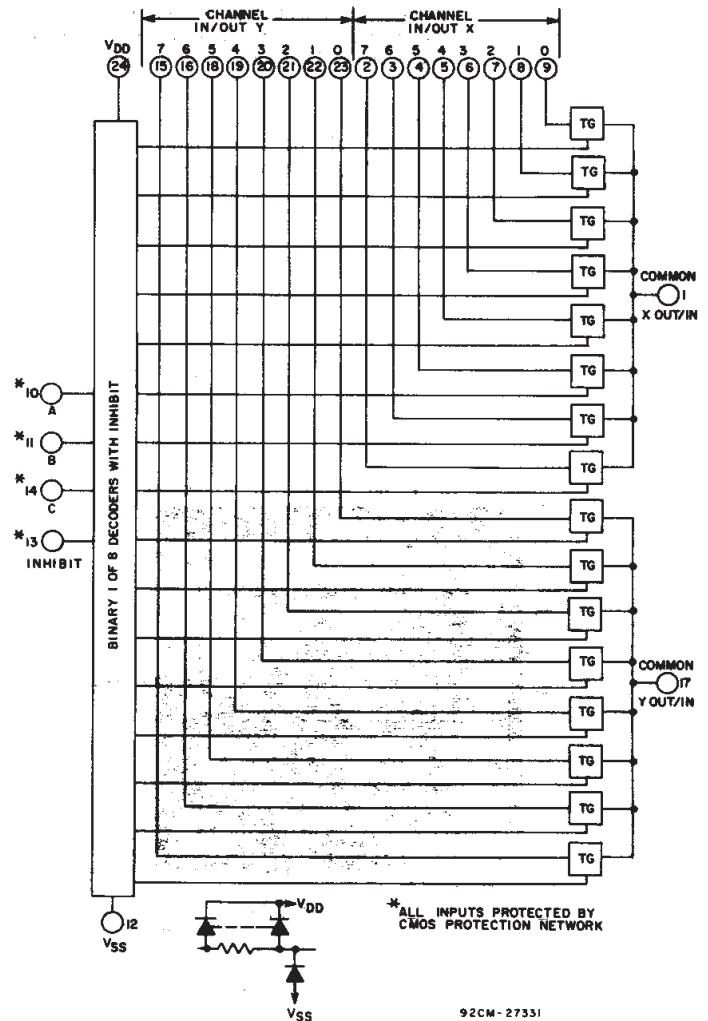


Fig. 17- CD4097 logic diagram.

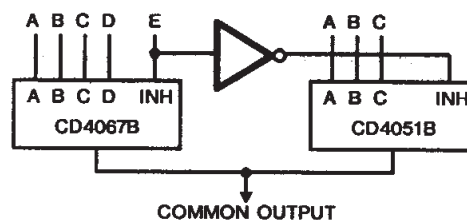


Fig. 18-24-to-1 MUX Addressing

CD4067B, CD4097B Types

SPECIAL CONSIDERATIONS

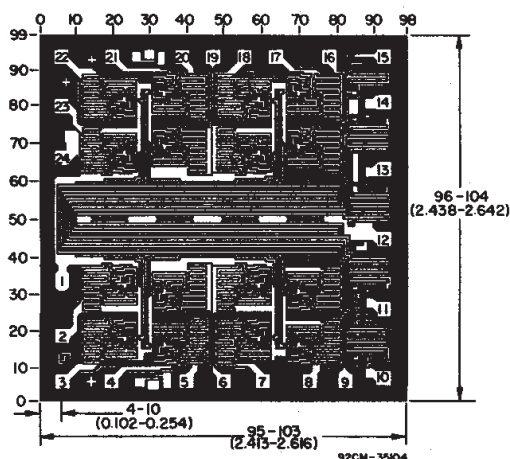
In applications where separate power sources are used to drive V_{DD} and the signal inputs, the V_{DD} current capability should exceed V_{DD}/R_L (R_L =effective external load). This provision avoids permanent current flow or clamp action on the V_{DD} supply when power is applied or removed from the CD4067B or CD4097B.

When switching from one address to another, some of the ON periods of the channels of the multiplexers will overlap momentarily, which may be objectionable in certain applications. Also when a channel is turned on or off by an address input, there is a momentary conductive path from the channel to V_{SS} , which will dump some charge from any capacitor connected to the input or output of the channel. The inhibit input turning on a channel will similarly dump some charge to V_{SS} .

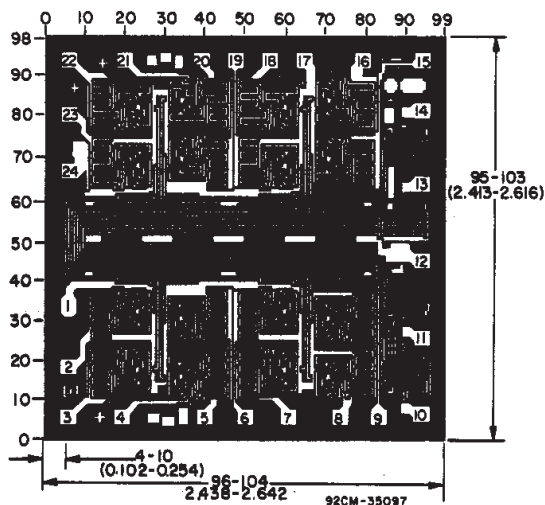
The amount of charge dumped is mostly a function of the signal level above V_{SS} . Typically, at $V_{DD}-V_{SS}=10$ V, a 100-pF

capacitor connected to the input or output of the channel will lose 3-4% of its voltage at the moment the channel turns on or off. This loss of voltage is essentially independent of the address or inhibit signal transition time, if the transition time is less than 1-2 μ s. When the inhibit signal turns a channel off, there is no charge dumping to V_{SS} . Rather, there is a slight rise in the channel voltage level (65 mV typ.) due to capacitive coupling from inhibit input to channel input or output. Address inputs also couple some voltage steps onto the channel signal levels.

In certain applications, the external load-resistor current may include both V_{DD} and signal-line components. To avoid drawing V_{DD} current when switch current flows into the transmission gate inputs, the voltage drop across the bidirectional switch must not exceed 0.8 volt (calculated from R_{ON} values shown in ELECTRICAL CHARACTERISTICS CHART). No V_{DD} current will flow through R_L if the switch current flows into terminal 1 on the CD4067B, terminals 1 and 17 on the CD4097B.



Dimensions and pad layout for CD4067BH.



Dimensions and pad layout for CD4097BH.

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



PACKAG

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak
CD4067BE	ACTIVE	PDIP	N	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
CD4067BEE4	ACTIVE	PDIP	N	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
CD4067BF	ACTIVE	CDIP	J	24	1	TBD	Call TI	N / A for Pkg
CD4067BF3A	ACTIVE	CDIP	J	24	1	TBD	Call TI	N / A for Pkg
CD4067BM	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
CD4067BM96	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
CD4067BM96E4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
CD4067BM96G4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
CD4067BME4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
CD4067BMG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
CD4067BPW	ACTIVE	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
CD4067BPWE4	ACTIVE	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
CD4067BPWG4	ACTIVE	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
CD4097BE	ACTIVE	PDIP	N	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
CD4097BEE4	ACTIVE	PDIP	N	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
CD4097BF	ACTIVE	CDIP	J	24	1	TBD	Call TI	N / A for Pkg
CD4097BM	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
CD4097BME4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600



PACKAG

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Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp
CD4097BMG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C
CD4097BPW	ACTIVE	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C
CD4097BPWE4	ACTIVE	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C
CD4097BPWG4	ACTIVE	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C
CD4097BPWR	ACTIVE	TSSOP	PW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C
CD4097BPWRE4	ACTIVE	TSSOP	PW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C
CD4097BPWRG4	ACTIVE	TSSOP	PW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C

⁽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.

OBSELETE: 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/rohs> for more 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 RoHS materials, except for lead, which may 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 high temperature applications.

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 attach material 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 and Sb are present 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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PACKAG

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Cu

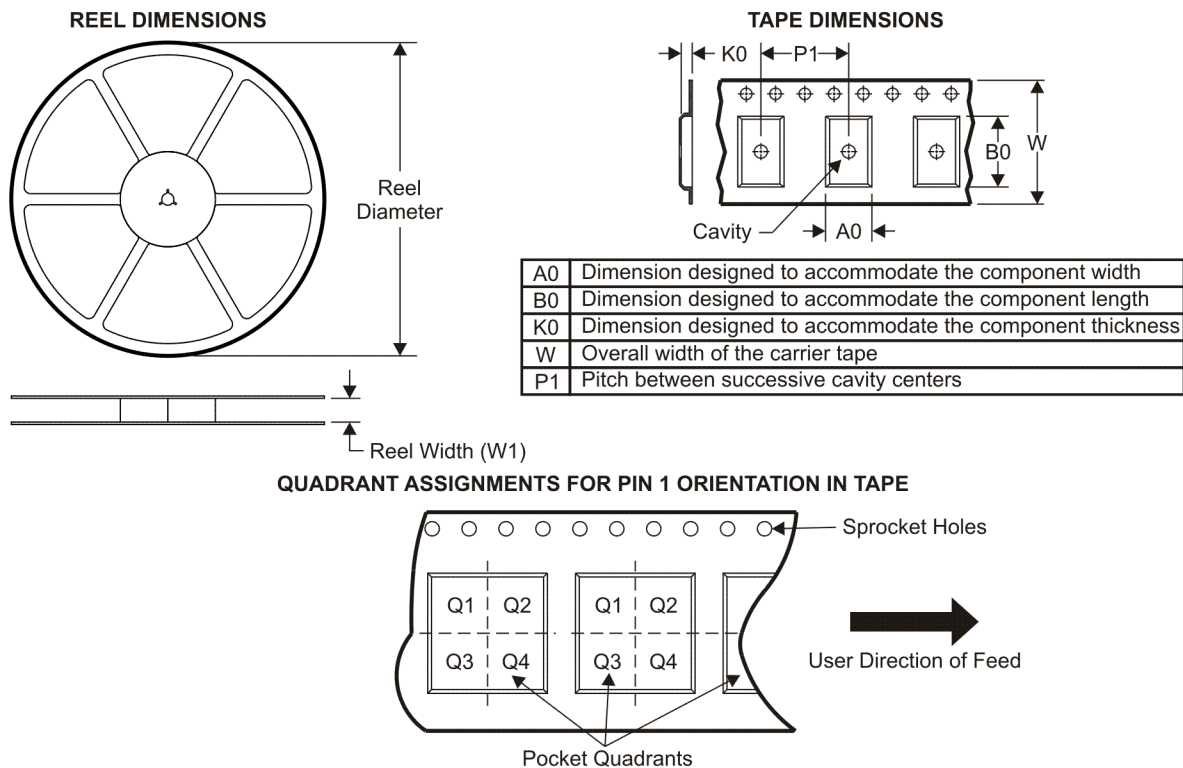
OTHER QUALIFIED VERSIONS OF CD4067B, CD4067B-MIL, CD4097B, CD4097B-MIL :

- Catalog: [CD4067B](#), [CD4097B](#)
- Military: [CD4067B-MIL](#), [CD4097B-MIL](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

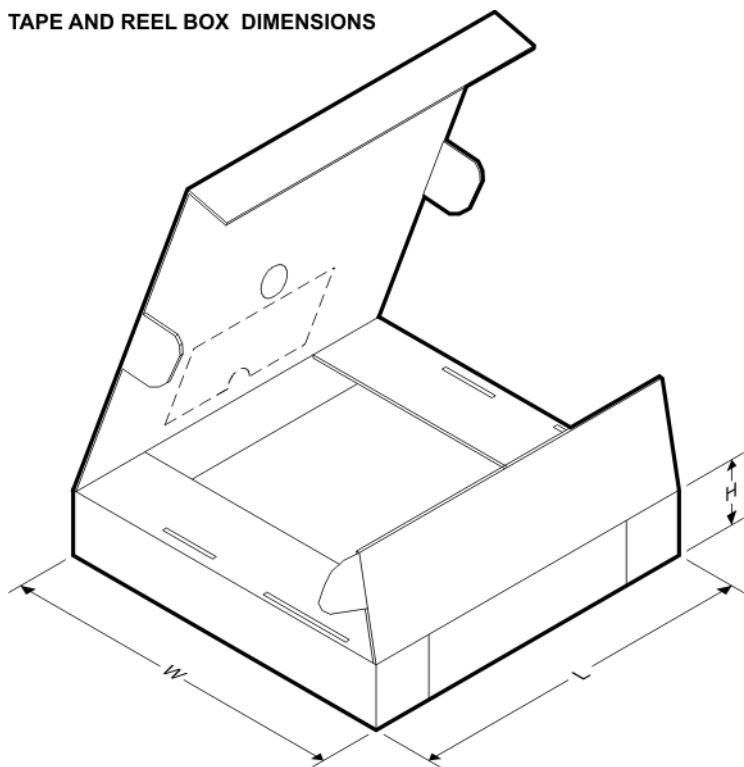
TAPE AND REEL INFORMATION



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CD4067BM96	SOIC	DW	24	2000	330.0	24.4	10.75	15.7	2.7	12.0	24.0	Q1
CD4097BPWR	TSSOP	PW	24	2000	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD4067BM96	SOIC	DW	24	2000	346.0	346.0	41.0
CD4097BPWR	TSSOP	PW	24	2000	346.0	346.0	33.0

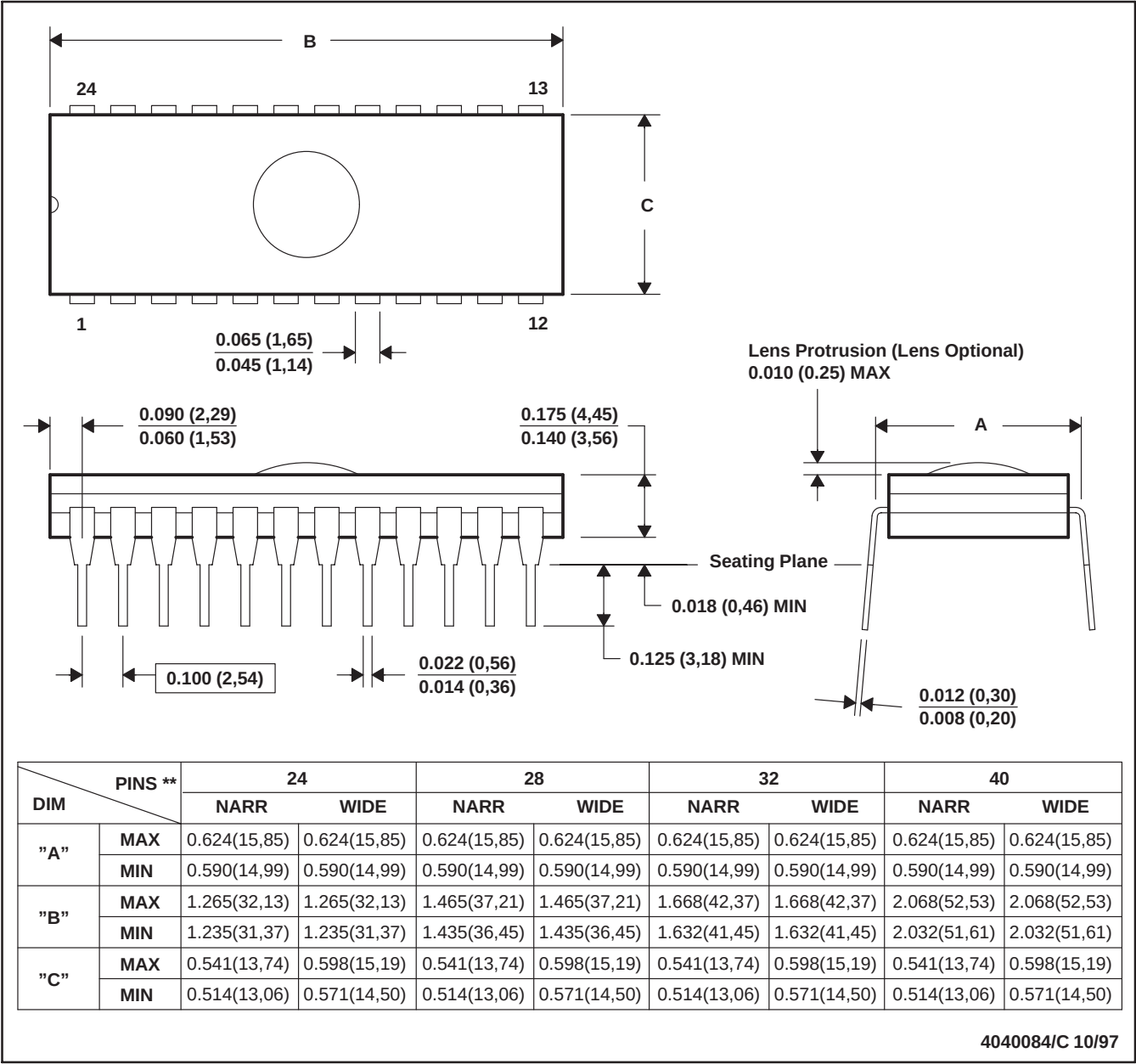
查询"CD4067B-MIL"供应商

MCDI004A – JANUARY 1995 – REVISED NOVEMBER 1997

J (R-GDIP-T**)

CERAMIC DUAL-IN-LINE PACKAGE

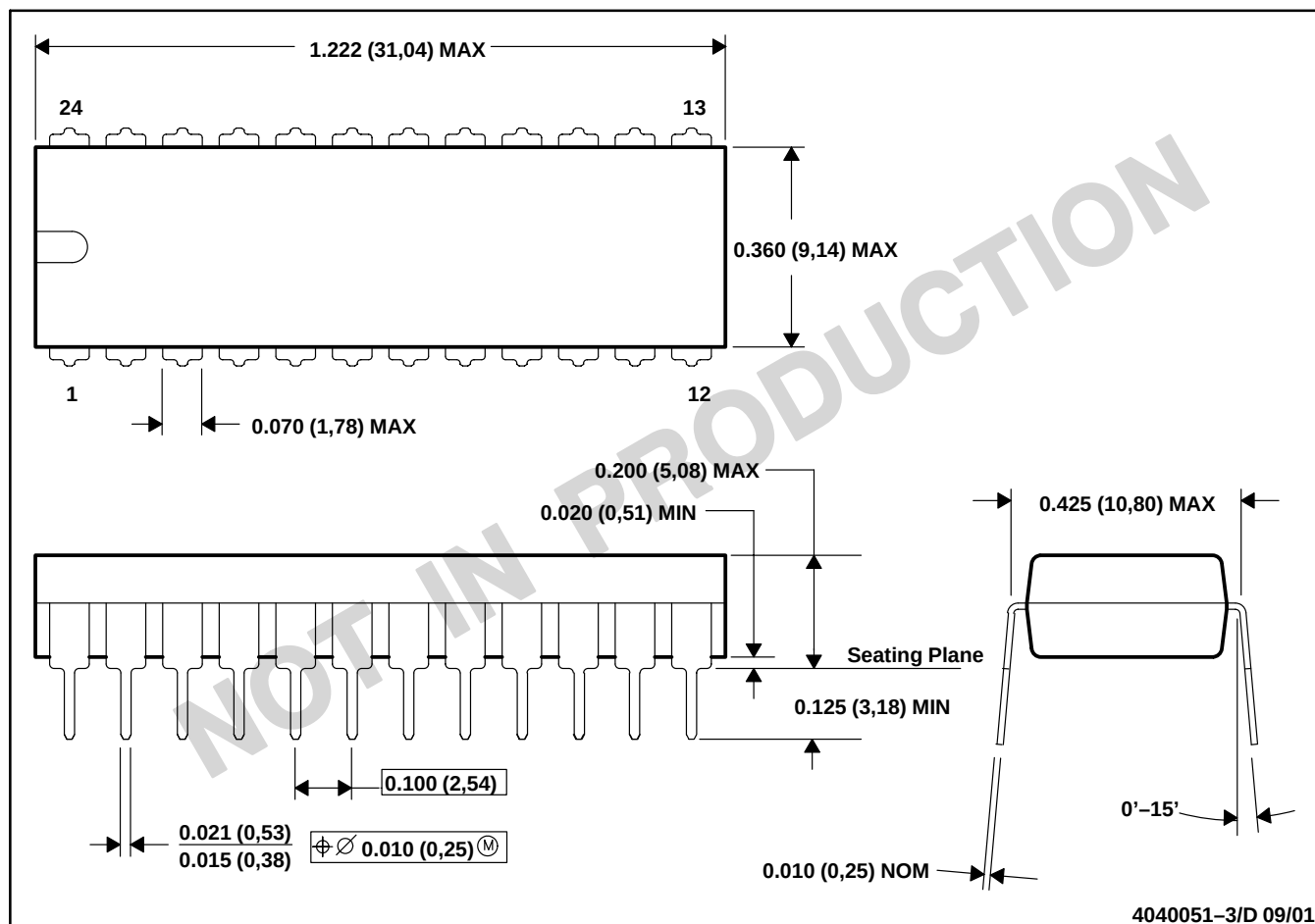
24 PINS SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Window (lens) added to this group of packages (24-, 28-, 32-, 40-pin).
D. This package can be hermetically sealed with a ceramic lid using glass frit.
E. Index point is provided on cap for terminal identification.

N (R-PDIP-T24)

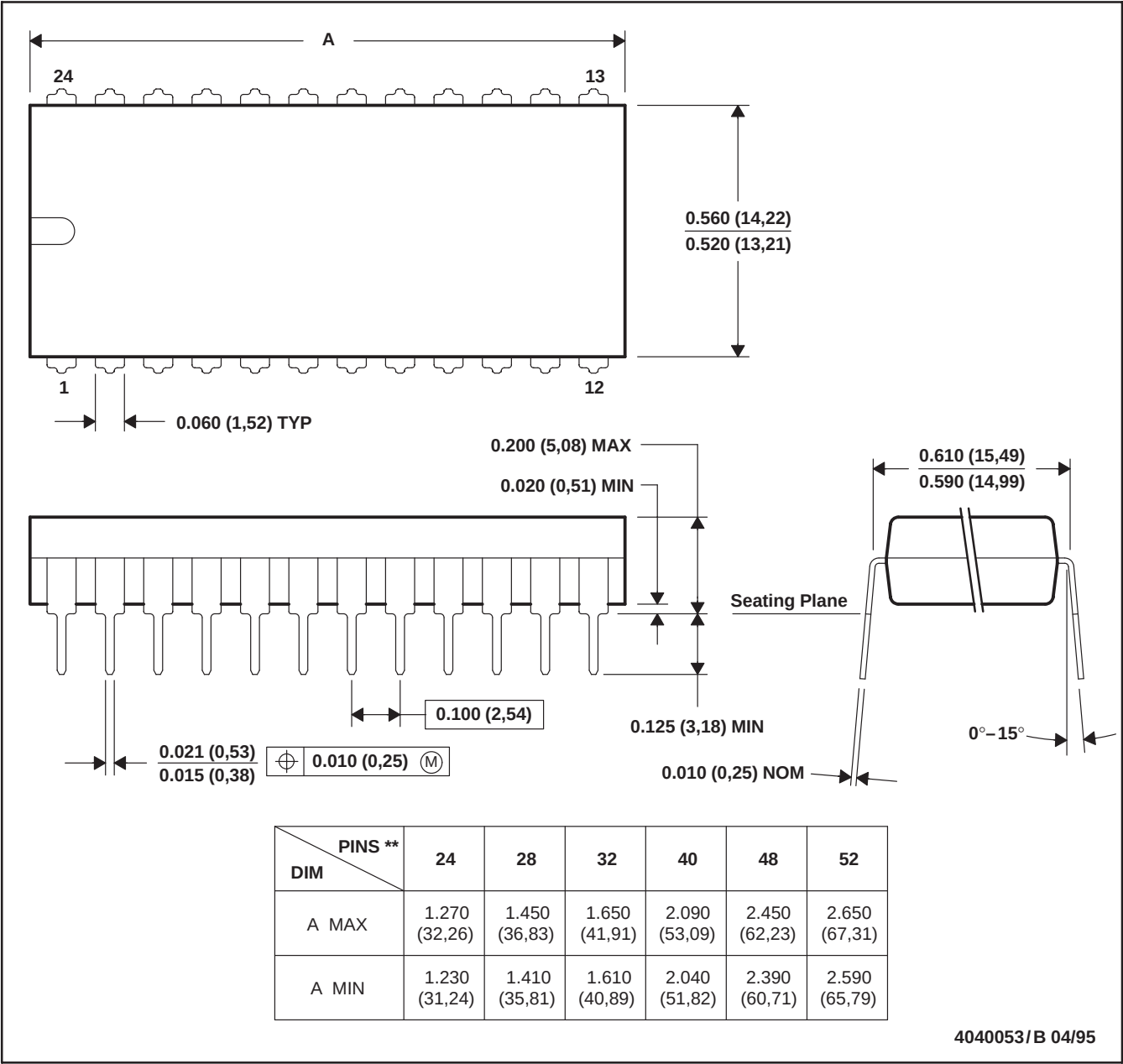
PLASTIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-010

N (R-PDIP-T**)
24 PIN SHOWN

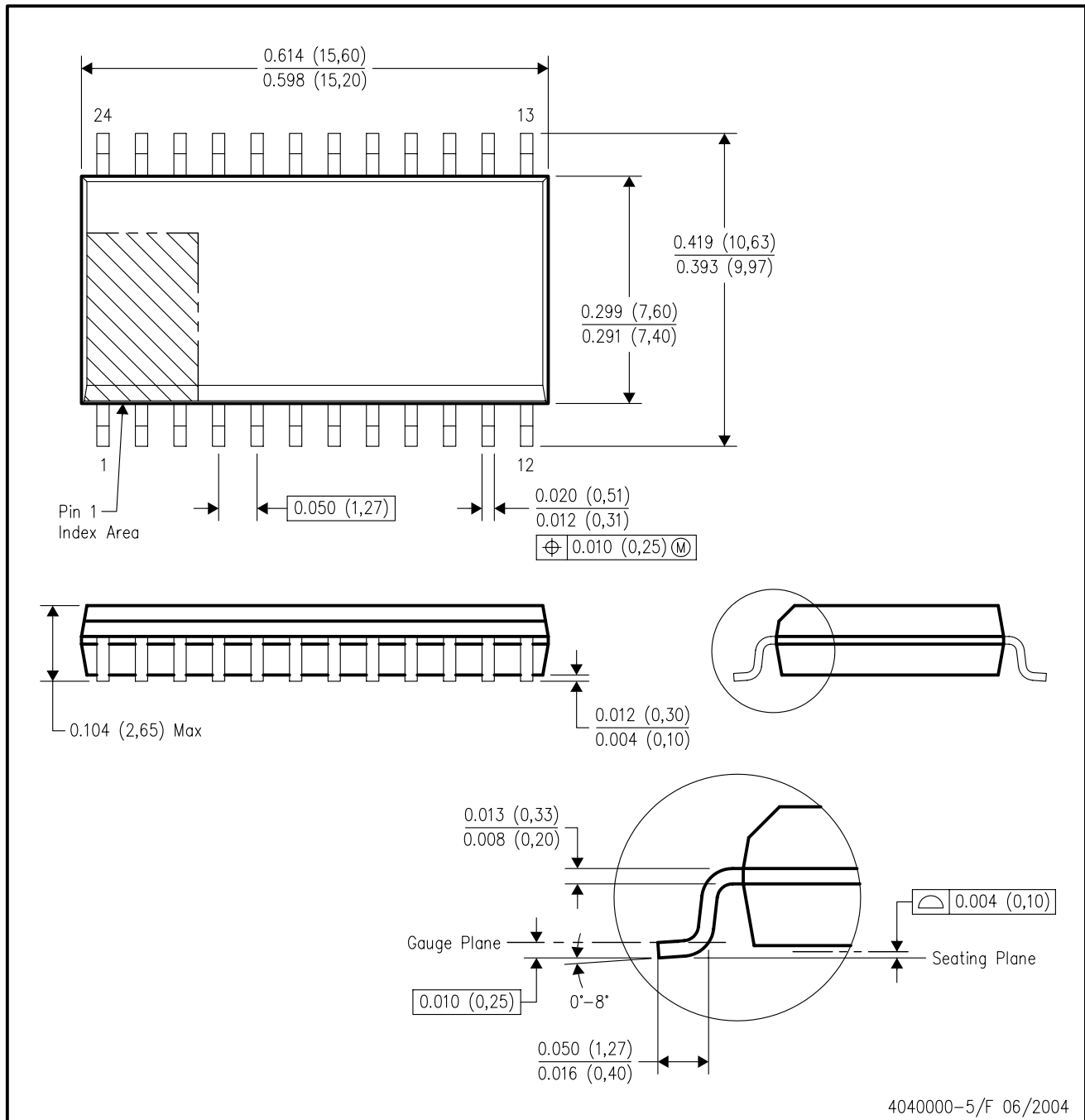
PLASTIC DUAL-IN-LINE PACKAGE



- NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-011
D. Falls within JEDEC MS-015 (32 pin only)

DW (R-PDSO-G24)

PLASTIC SMALL-OUTLINE PACKAGE



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

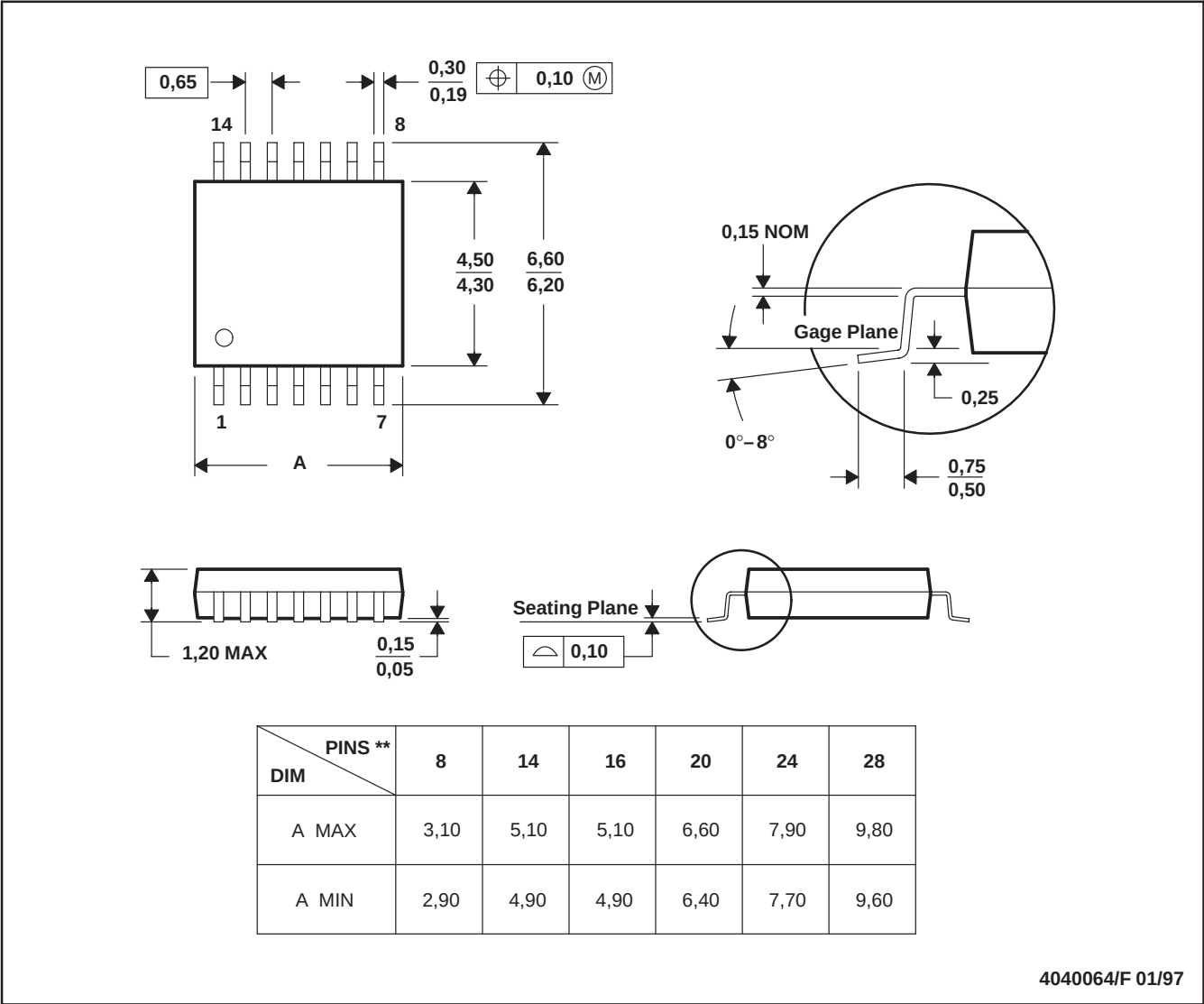
[查询"CD4067B-MIL"供应商](#)

MTSS001C – JANUARY 1995 – REVISED FEBRUARY 1999

PW (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.
D. Falls within JEDEC MO-153

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