

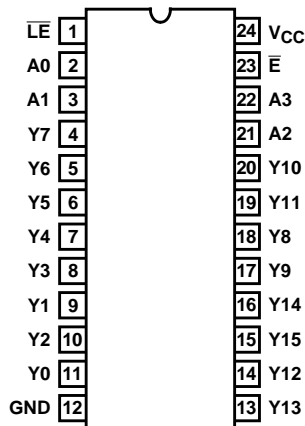
High-Speed CMOS Logic 4- to 16-Line Decoder/Demultiplexer with Input Latches

Features

- Multifunction Capability
 - Binary to 1-of-16 Decoder
 - 1-to-16 Line Demultiplexer
- Fanout (Over Temperature Range)
 - Standard Outputs 10 LSTTL Loads
 - Bus Driver Outputs 15 LSTTL Loads
- Wide Operating Temperature Range . . . -55°C to 125°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
 - 2V to 6V Operation
 - High Noise Immunity: $N_{IL} = 30\%$, $N_{IH} = 30\%$ of V_{CC} at $V_{CC} = 5V$

Pinout

CD54HC4514
(CERDIP)
CD74HC4514, CD74HC4515
(PDIP, SOIC)
TOP VIEW



Description

The CD54HC4514, CD74HC4514, and CD74HC4515 are high-speed silicon gate devices consisting of a 4-bit strobed latch and a 4- to 16-line decoder. The selected output is enabled by a low on the enable input (E). A high on \bar{E} inhibits selection of any output. Demultiplexing is accomplished by using the \bar{E} input as the data input and the select inputs (A0-A3) as addresses. This \bar{E} input also serves as a chip select when these devices are cascaded.

When Latch Enable (\bar{LE}) is high the output follows changes in the inputs (see truth table). When \bar{LE} is low the output is isolated from changes in the input and remains at the level (high for the 4514, low for the 4515) it had before the latches were enabled. These devices, enhanced versions of the equivalent CMOS types, can drive 10 LSTTL loads.

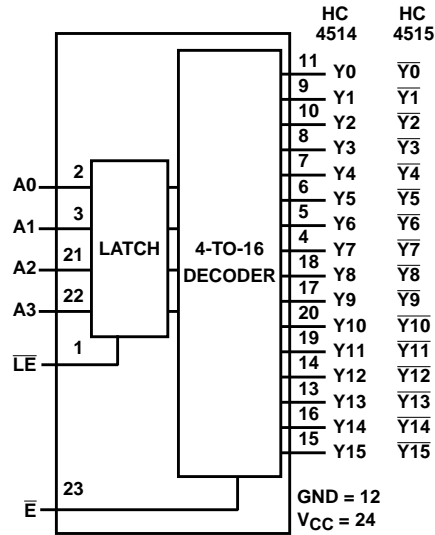
Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54HC4514F3A	-55 to 125	24 Ld CERDIP
CD74HC4514E	-55 to 125	24 Ld PDIP
CD74HC4514EN	-55 to 125	24 Ld PDIP
CD74HC4514M	-55 to 125	24 Ld SOIC
CD74HC4514M96	-55 to 125	24 Ld SOIC
CD74HC4515E	-55 to 125	24 Ld PDIP
CD74HC4515EN	-55 to 125	24 Ld PDIP
CD74HC4515M	-55 to 125	24 Ld SOIC
CD74HC4515M96	-55 to 125	24 Ld SOIC

NOTE: When ordering, use the entire part number. The suffix 96 denotes tape and reel.

CD54HC4514, CD74HC4514, CD74HC4515

Functional Diagram



DECODE TRUTH TABLE ($\overline{LE} = 1$)

ENABLE	DECODER INPUTS				ADDRESSED OUTPUT 4514 = LOGIC 1 (HIGH) 4515 = LOGIC 0 (HIGH)
	A3	A2	A1	A0	
0	0	0	0	0	Y0
0	0	0	0	1	Y1
0	0	0	1	0	Y2
0	0	0	1	1	Y3
0	0	1	0	0	Y4
0	0	1	0	1	Y5
0	0	1	1	0	Y6
0	0	1	1	1	Y7
0	1	0	0	0	Y8
0	1	0	0	1	Y9
0	1	0	1	0	Y10
0	1	0	1	1	Y11
0	1	1	0	0	Y12
0	1	1	0	1	Y13
0	1	1	1	0	Y14
0	1	1	1	1	Y15
1	X	X	X	X	All Outputs = 0, 4514 All Outputs = 1, 4515

X = Don't Care; Logic 1 = High; Logic 0 = Low

CD54HC4514, CD74HC4514, CD74HC4515

Absolute Maximum Ratings

DC Supply Voltage, V_{CC}	-0.5V to 7V
DC Input Diode Current, I_{IK}	
For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$	$\pm 20mA$
DC Output Diode Current, I_{OK}	
For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$	$\pm 20mA$
DC Drain Current, per Output, I_O	
For $-0.5V < V_O < V_{CC} + 0.5V$	$\pm 25mA$
DC Output Source or Sink Current per Output Pin, I_O	
For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$	$\pm 25mA$
DC V_{CC} or Ground Current, I_{CC}	$\pm 50mA$

Thermal Information

Thermal Resistance (Typical)	θ_{JA} ($^{\circ}C/W$)
E (PDIP) Package (Note 1)	67
EN (PDIP) Package (Note 1)	67
M (SOIC) Package (Note 2)	46
Maximum Junction Temperature	150 $^{\circ}C$
Maximum Storage Temperature Range	-65 $^{\circ}C$ to 150 $^{\circ}C$
Maximum Lead Temperature (Soldering 10s)	300 $^{\circ}C$ (SOIC - Lead Tips Only)

Operating Conditions

Temperature Range (T_A)	-55 $^{\circ}C$ to 125 $^{\circ}C$
Supply Voltage Range, V_{CC}	
HC Types	2V to 6V
DC Input or Output Voltage, V_I , V_O	0V to V_{CC}
Input Rise and Fall Time	
2V	1000ns (Max)
4.5V	500ns (Max)
6V	400ns (Max)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTES:

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

DC Electrical Specifications

PARAMETER	SYMBOL	TEST CONDITIONS		V_{CC} (V)	25 $^{\circ}C$			-40 $^{\circ}C$ TO 85 $^{\circ}C$		-55 $^{\circ}C$ TO 125 $^{\circ}C$		UNITS	
		V_I (V)	I_O (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX		
HC TYPES													
High Level Input Voltage	V_{IH}	-	-	2	1.5	-	-	1.5	-	1.5	-	V	
				4.5	3.15	-	-	3.15	-	3.15	-	V	
				6	4.2	-	-	4.2	-	4.2	-	V	
Low Level Input Voltage	V_{IL}	-	-	2	-	-	0.5	-	0.5	-	0.5	V	
				4.5	-	-	1.35	-	1.35	-	1.35	V	
				6	-	-	1.8	-	1.8	-	1.8	V	
High Level Output Voltage CMOS Loads	V_{OH}	V_{IH} or V_{IL}	-0.02	-0.02	2	1.9	-	-	1.9	-	1.9	-	V
			-0.02	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
			-0.02	-0.02	6	5.9	-	-	5.9	-	5.9	-	V
High Level Output Voltage TTL Loads	V_{OH}	V_{IH} or V_{IL}	-	-	-	-	-	-	-	-	-	V	
			-4	-4	4.5	3.98	-	-	3.84	-	3.7	-	V
			-5.2	-5.2	6	5.48	-	-	5.34	-	5.2	-	V

CD54HC4514, CD74HC4514, CD74HC4515

DC Electrical Specifications (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS		V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
		V _I (V)	I _O (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX	
Low Level Output Voltage CMOS Loads	V _{OL}	V _{IH} or V _{IL}	0.02	2	-	-	0.1	-	0.1	-	0.1	V
			0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
			0.02	6	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads	V _{OL}	V _{IH} or V _{IL}	-	-	-	-	-	-	-	-	-	V
			4	4.5	-	-	0.26	-	0.33	-	0.4	V
			5.2	6	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I _I	V _{CC} or GND	-	6	-	-	±0.1	-	±1	-	±1	µA
Quiescent Device Current	I _{CC}	V _{CC} or GND	0	6	-	-	8	-	80	-	160	µA

Prerequisite For Switching Specifications

PARAMETER	SYMBOL	TEST CONDITIONS	V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HC TYPES											
LE Pulse Width	t _W	-	2	75	-	-	95	-	110	-	ns
			4.5	30	-	-	19	-	22	-	ns
			6	35	-	-	16	-	19	-	ns
Select to LE Set-Up Time	t _{SU}	-	2	100	-	-	125	-	150	-	ns
			4.5	20	-	-	25	-	30	-	ns
			6	17	-	-	21	-	26	-	ns
Select to LE Hold Time	t _H	-	2	0	-	-	0	-	0	-	ns
			4.5	0	-	-	0	-	0	-	ns
			6	0	-	-	0	-	0	-	ns

Switching Specifications C_L = 50pF, Input t_r, t_f = 6ns

PARAMETER	SYMBOL	TEST CONDITIONS	V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HC TYPES											
Propagation Delay Select to Outputs	t _{PHL} , t _{PLH}	C _L = 50pF	2	-	-	275	-	345	-	415	ns
			4.5	-	-	55	-	69	-	83	ns
		C _L = 15pF	5	-	23	-	-	-	-	-	ns
		C _L = 50pF	6	-	-	47	-	59	-	71	ns
LE to Outputs	t _{PHL} , t _{PLH}	C _L = 50pF	2	-	-	225	-	280	-	340	ns
			4.5	-	-	45	-	56	-	68	ns
		C _L = 15pF	5	-	19	-	-	-	-	-	ns
		C _L = 50pF	6	-	-	38	-	48	-	58	ns

CD54HC4514, CD74HC4514, CD74HC4515

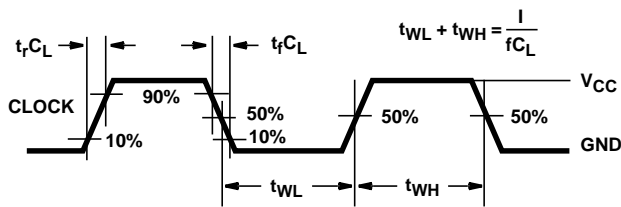
Switching Specifications $C_L = 50\text{pF}$, Input $t_r, t_f = 6\text{ns}$ (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS	V_{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS	
				MIN	TYP	MAX	MIN	MAX	MIN	MAX		
\bar{E} to Outputs	t_{PHL}, t_{PLH}	$C_L = 50\text{pF}$	2	-	-	175	-	220	-	265	ns	
			4.5	-	-	35	-	44	-	53	ns	
			$C_L = 15\text{pF}$	5	-	14	-	-	-	-	-	ns
			$C_L = 50\text{pF}$	6	-	-	30	-	37	-	45	ns
Output Transition Time	t_{THL}, t_{TLH}	$C_L = 50\text{pF}$	2	-	-	75	-	95	-	110	ns	
			4.5	-	-	15	-	19	-	22	ns	
			6	-	-	13	-	16	-	19	ns	
Input Capacitance	C_{IN}	$C_L = 50\text{pF}$	-	10	-	10	-	10	-	10	pF	
Power Dissipation Capacitance (Notes 3, 4)	C_{PD}	-	5	-	70	-	-	-	-	-	pF	

NOTES:

3. C_{PD} is used to determine the dynamic power consumption, per package.
4. $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$ where f_i = Input Frequency, C_L = Output Load Capacitance, V_{CC} = Supply Voltage.

Test Circuits and Waveforms



NOTE: Outputs should be switching from 10% V_{CC} to 90% V_{CC} in accordance with device truth table. For f_{MAX} , input duty cycle = 50%.

FIGURE 1. HC CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH

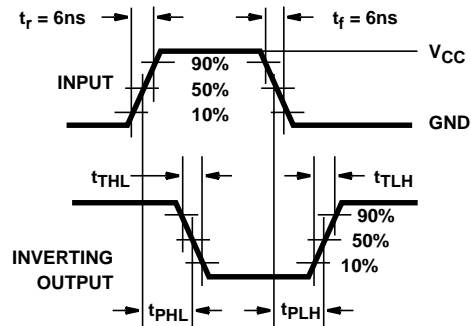


FIGURE 2. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

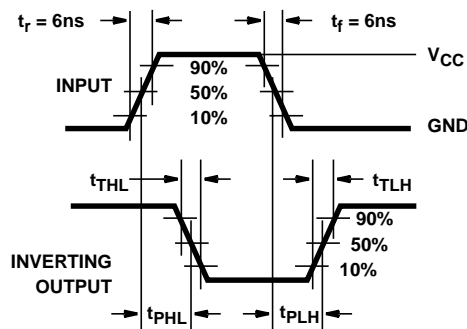


FIGURE 3. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

Test Circuits and Waveforms (Continued)

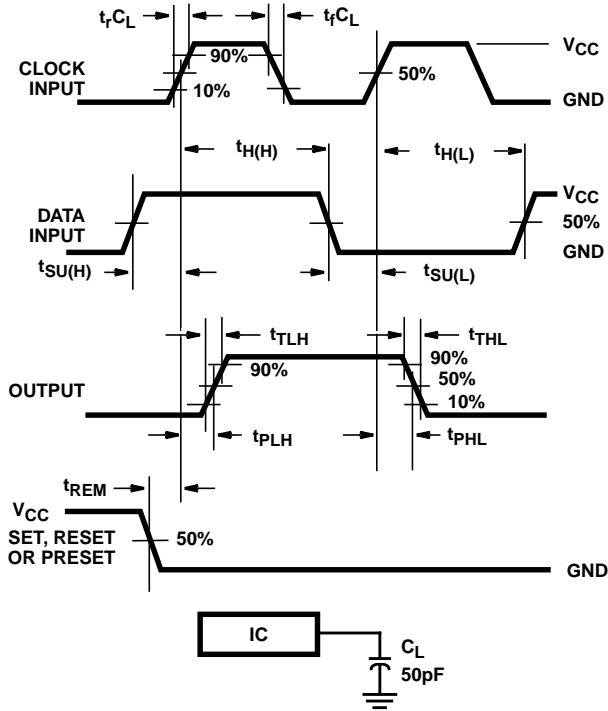


FIGURE 4. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

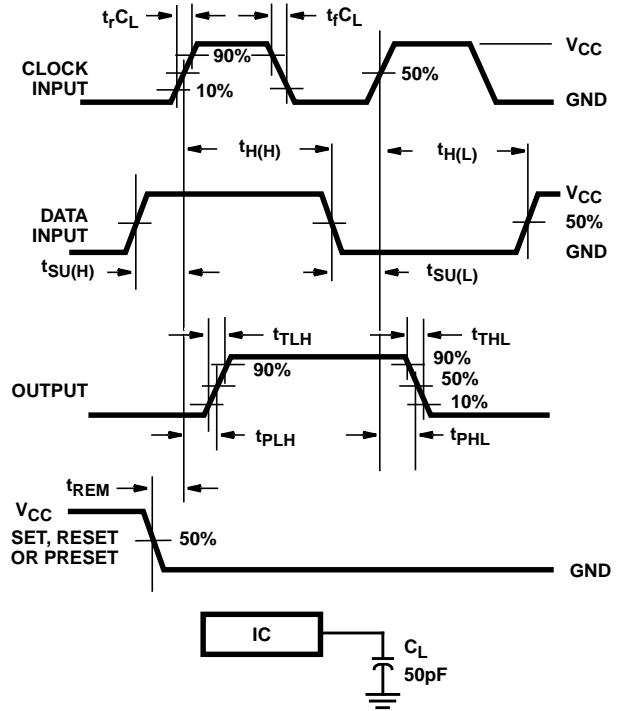


FIGURE 5. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9865501QJA	ACTIVE	CDIP	J	24	1	Non-RoHS & Non-Green	Call TI	N / A for Pkg Type	-55 to 125	5962-9865501QJ A CD54HC4514F3A	Samples
CD54HC4514F3A	ACTIVE	CDIP	J	24	1	Non-RoHS & Non-Green	Call TI	N / A for Pkg Type	-55 to 125	5962-9865501QJ A CD54HC4514F3A	Samples
CD74HC4514M	ACTIVE	SOIC	DW	24	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC4514M	Samples
CD74HC4514M96	ACTIVE	SOIC	DW	24	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC4514M	Samples
CD74HC4515M	ACTIVE	SOIC	DW	24	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC4515M	Samples
CD74HC4515M96	ACTIVE	SOIC	DW	24	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC4515M	Samples

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

⁽⁶⁾ Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF CD54HC4514, CD74HC4514 :

- Catalog: [CD74HC4514](#)
- Military: [CD54HC4514](#)

NOTE: Qualified Version Definitions:

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

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*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
CD74HC4514M96	SOIC	DW	24	2000	330.0	24.4	10.75	15.7	2.7	12.0	24.0	Q1
CD74HC4515M96	SOIC	DW	24	2000	330.0	24.4	10.75	15.7	2.7	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD74HC4514M96	SOIC	DW	24	2000	350.0	350.0	43.0
CD74HC4515M96	SOIC	DW	24	2000	350.0	350.0	43.0

TUBE

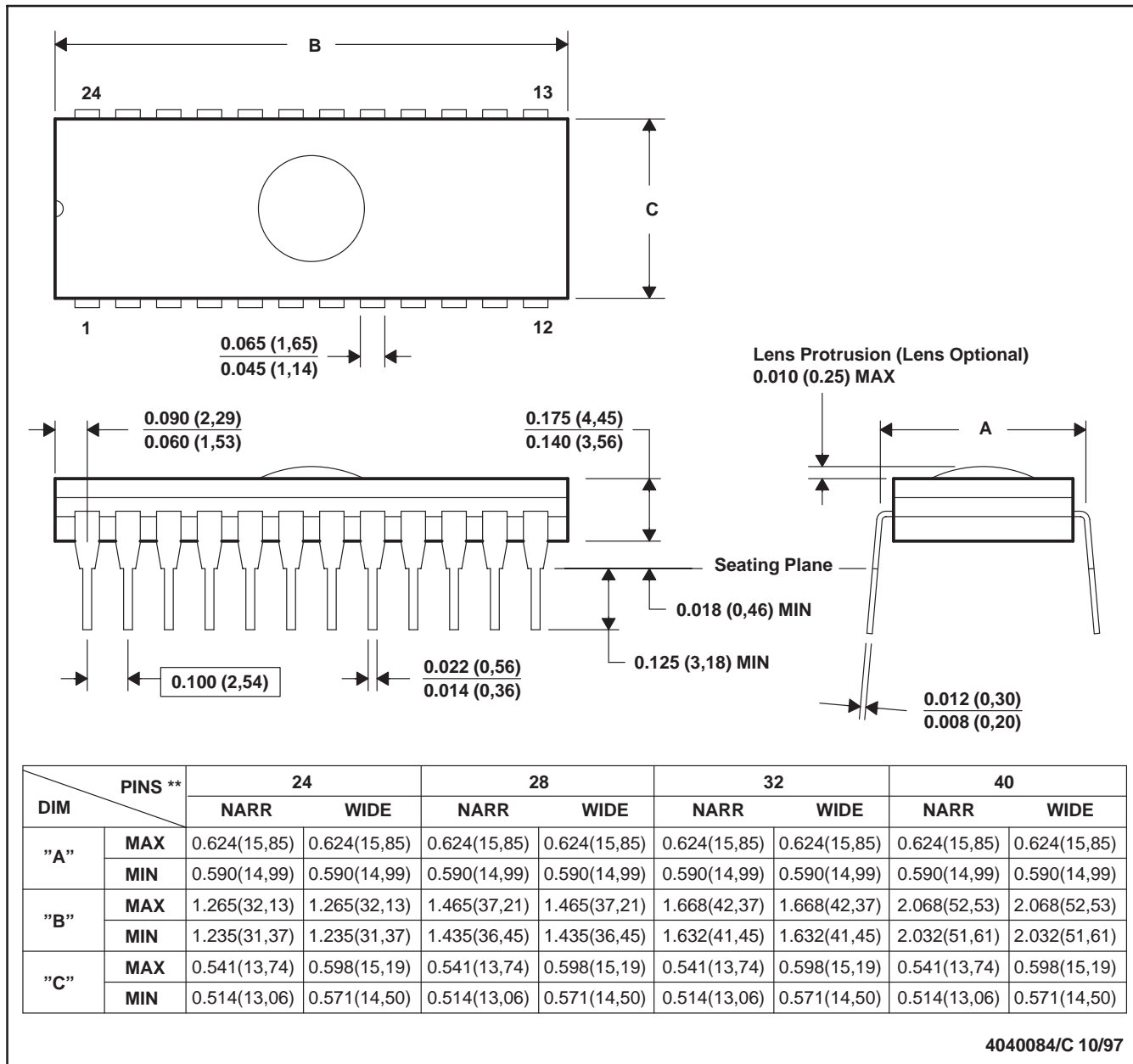

*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
CD74HC4514M	DW	SOIC	24	25	506.98	12.7	4826	6.6
CD74HC4515M	DW	SOIC	24	25	506.98	12.7	4826	6.6

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.

DW (R-PDSO-G24)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
 - 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.

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