

T-46-09-05

CD4021A Types

CMOS 8-Stage Static Shift Register

Asynchronous Parallel Input/Serial Output,
Synchronous Serial Input/Serial Output

The RCA-CD4021A types are 8-stage parallel or serial-input/serial-output shift registers having common CLOCK and PARALLEL/SERIAL CONTROL inputs, a single SERIAL DATA input, and individual parallel Jam inputs to each register stage. Each register stage is a D-type, master-slave flip-flop. Q outputs are available from the sixth, seventh, and eighth stages.

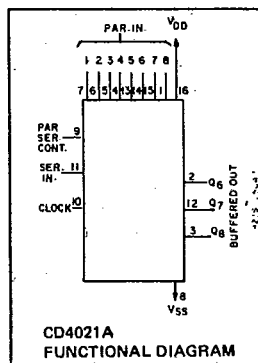
When the PARALLEL/SERIAL CONTROL input is low, data are serially shifted into the 8-stage register synchronously with the positive-going transition of the CLOCK pulse.

Features:

- Asynchronous parallel or synchronous serial operation under control of parallel/serial control-input
- Individual JAM inputs to each register stage
- Master-slave flip-flop register stages
- Fully static operation. . . . DC to 5 MHz
- Quiescent current specified to 15 μ A
- Maximum input leakage current of 1 μ A at 15 V (full package-temperature range)
- 1-V noise margin (full package-temperature range)

When the PARALLEL/SERIAL CONTROL input is high, data are jammed into the 8-stage register via the parallel input lines asynchronously with the clock line.

Register expansion is possible using addi-



tional CD4021A packages.

These types are supplied in 16-lead hermetic dual-in-line ceramic packages (D and F suffixes), 16-lead dual-in-line plastic package (E suffix), 16-lead ceramic flat package (K suffix), and in chip form (H suffix).

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTICS	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)								UNITS
	V _O (V)	V _{IN} (V)	V _{DD} (V)	D, F, K, H PACKAGES				E PACKAGE				
				-55	+25		+125	-40	+25		+85	
Quiescent Device Current I _L Max.	-	-	5	5	0.5	5	300	50	0.5	50	700	μ A
	-	-	10	10	1	10	600	100	1	100	1400	
	-	-	15	50	1	50	2000	500	5	500	5000	
Output Voltage: Low-Level, V _{OL}	-	5	5	0 Typ.; 0.05 Max.								V
	-	10	10	0 Typ.; 0.05 Max.								
High Level V _{OH}	-	0	5	4.95 Min.; 5 Typ.								V
	-	0	10	9.95 Min.; 10 Typ.								
Noise Immunity: Inputs Low, V _{NL}	4.2	-	5	1.5 Min.; 2.25 Typ.								V
	9	-	10	3 Min.; 4.5 Typ.								
Inputs High V _{NH}	0.8	-	5	1.5 Min.; 2.25 Typ.								V
	1	-	10	3 Min.; 4.5 Typ.								
Noise Margin: Inputs Low, V _{NML}	4.5	-	5	1 Min.								V
	9	-	10	1 Min.								
Inputs High, V _{NMH}	0.5	-	5	1 Min.								V
	1	-	10	1 Min.								
Output Drive Current: N-Channel (Sink), I _{DN} Min.	0.5	-	5	0.15	0.3	0.12	0.085	0.072	0.3	0.06	0.05	mA
	0.5	-	10	0.31	0.5	0.25	0.175	0.12	0.5	0.1	0.08	
P-Channel (Source) I _{DP} Min.	4.5	-	5	-0.1	-0.16	-0.08	-0.055	-0.06	-0.16	-0.05	-0.04	mA
	9.5	-	10	-0.25	-0.44	-0.20	-0.14	-0.12	-0.44	-0.1	-0.08	
Input Leakage Current, I _{IL} , I _{IH}	-	-	15	$\pm 10^{-5}$ Typ., ± 1 Max.								

Applications:

- Parallel to serial data conversion
- Asynchronous parallel input/serial output data queuing
- General purpose register

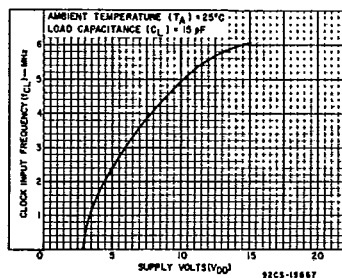


Fig. 1 - Typical clock input frequency vs. supply voltage.

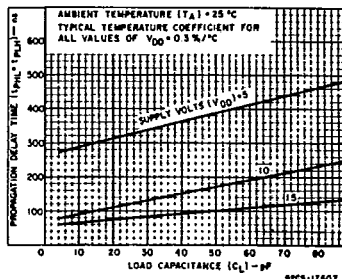


Fig. 2 - Typical propagation delay time vs. load capacitance.

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MAXIMUM RATINGS, Absolute-Maximum Values:

- STORAGE-TEMPERATURE RANGE (T_{STG}) -85 to +150°C
- OPERATING-TEMPERATURE RANGE (T_A)
 - PACKAGE TYPES D, F, K, H -55 to +125°C
 - PACKAGE TYPE E -40 to +85°C
- DC SUPPLY-VOLTAGE RANGE, (V_{DD})
 - (Voltages referenced to V_{SS} Terminal) -0.5 to +15 V
- POWER DISSIPATION PER PACKAGE (P_D)
 - FOR $T_A = -40$ to +60°C (PACKAGE TYPE E) 500 mW
 - FOR $T_A = +60$ to +85°C (PACKAGE TYPE E) Derate Linearly at 12 mW/°C to 200 mW
 - FOR $T_A = -65$ to +100°C (PACKAGE TYPES D, F, K) 500 mW
 - FOR $T_A = +100$ to +125°C (PACKAGE TYPES D, F, K) Derate Linearly at 12 mW/°C to 200 mW
- DEVICE DISSIPATION PER OUTPUT TRANSISTOR
 - FOR $T_A =$ FULL PACKAGE-TEMPERATURE RANGE (ALL PACKAGE TYPES) 100 mW
- INPUT VOLTAGE RANGE, ALL INPUTS -0.5 to $V_{DD} + 0.5$ V
- LEAD TEMPERATURE (DURING SOLDERING):
 - At distance 1/16 ± 1/32 inch (1.59 ± 0.79 mm) from case for 10 s max. +265°C

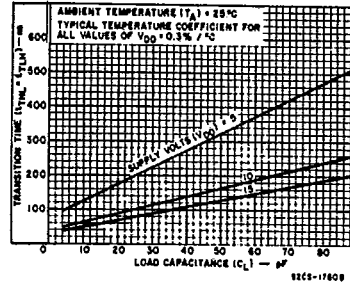


Fig. 3 - Typical transition time vs. load capacitance.

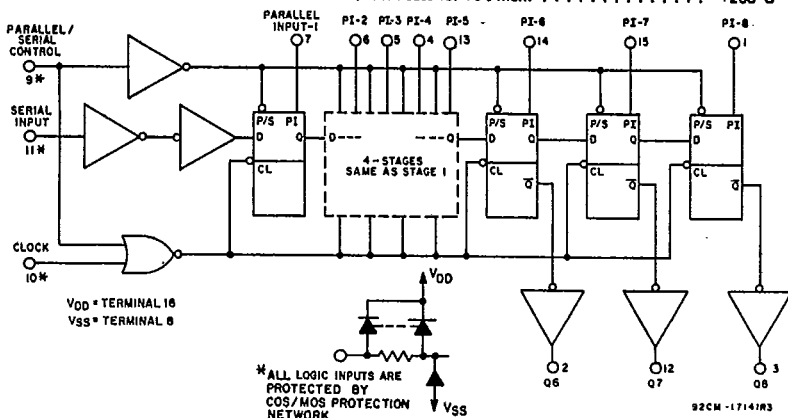


Fig. 5 - Logic diagram.

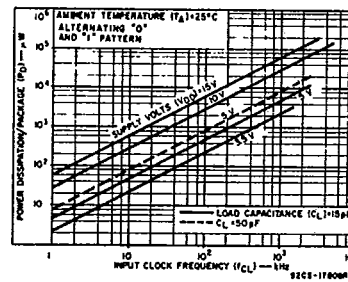


Fig. 4 - Typical dissipation characteristics.

RECOMMENDED OPERATING CONDITIONS at $T_A = 25^\circ\text{C}$, Except as Noted.
 For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

TRUTH TABLE

CL ^A	Serial Input	Parallel/Serial Control	PI-1	PI-n	Q ₁ (Internal)	Q _n
X	X	1	0	0	0	0
X	X	1	0	1	0	1
X	X	1	1	0	1	0
X	X	1	1	1	1	1
—	0	0	X	X	0	Q _{n-1}
—	1	0	X	X	1	Q _{n-1}
—	X	0	X	X	Q ₁	Q _n

^A = LEVEL CHANGE X = DON'T CARE CASE

NO CHANGE

92CS-17141R3

Fig. 6 - Truth table.

CHARACTERISTIC	V_{DD} (V)	LIMITS				UNITS
		D, F, K, H PACKAGES		E PACKAGE		
		MIN.	MAX.	MIN.	MAX.	
Supply-Voltage Range (For $T_A =$ Full Package-Temperature Range)		3	12	3	12	V
Data Setup Time, t_S	5 10	350 80	—	500 100	—	ns
Clock Pulse Width, t_W	5 10	500 175	—	830 200	—	ns
Clock Input Frequency, f_{CL}	5 10	dc dc	1 3	dc dc	0.6 2.5	MHz
Clock Rise and Fall Time, t_{rCL} , t_{fCL} [*]	5 10	— —	15 5	— —	15 5	μs

^{*}If more than one unit is cascaded t_{rCL} should be made less than or equal to the sum of the transition time and the fixed propagation delay of the output of the driving stage for the estimated capacitive load.

CD4021A Types

DYNAMIC ELECTRICAL CHARACTERISTICS
 at $T_A = 25^\circ C$, Input $t_r, t_f = 20 ns$, $C_L = 15 pF$, $R_L = 200 k\Omega$

CHARACTERISTIC	TEST CONDITIONS	LIMITS						UNITS	
		VDD (V)	D, F, K, H PACKAGES			E PACKAGE			
			MIN.	TYP.	MAX.	MIN.	TYP.		MAX.
Propagation Delay Time,** t_{PLH}, t_{PHL}		5	-	300	750	-	300	1000	ns
		10	-	100	225	-	300	300	
Transition Time; t_{THL}, t_{TLH}		5	-	150	300	-	150	400	ns
		10	-	75	125	-	75	150	
Maximum Clock Input Frequency, f_{CL}		5	1	2.5	-	0.6	2.5	-	MHz
		10	3	5	-	2.5	5	-	
Minimum Clock Pulse Width, t_w		5	-	200	500	-	200	830	ns
		10	-	100	175	-	100	200	
Clock Rise & Fall Time; t_{rCL} & t_{fCL} *		5	-	-	15	-	-	15	μs
		10	-	-	5	-	-	5	
Minimum Data Set Up Time, t_s		5	-	100	350	-	100	500	ns
		10	-	50	80	-	50	100	
Minimum High-Level Parallel/Serial Control Pulse Width t_w		5	-	200	500	-	200	830	ns
		10	-	100	175	-	100	200	
Input Capacitance C_i	Any Input	-	5	-	-	5	-	pF	

*If more than one unit is cascaded t_{rCL} should be made less than or equal to the sum of the transition time and the fixed propagation delay of the output of the driving stage for the estimated capacitive load.
 **From Clock or Parallel/Serial Control Input

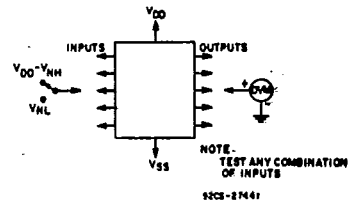


Fig. 7 - Noise-immunity test circuit.

Test performed with the following sequence of "One's" and "Zero's",

S ₁	S ₂	S ₃	S ₄	S ₅
0	0	1	0	0
1	0	1	1	1
1	0	1	0	1
0	1	1	1	1
0	1	0	0	0

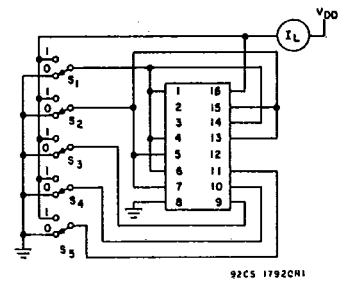


Fig. 8 - Quiescent device current test circuit.

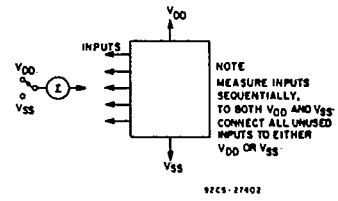


Fig. 9 - Input-leakage-current test circuit.

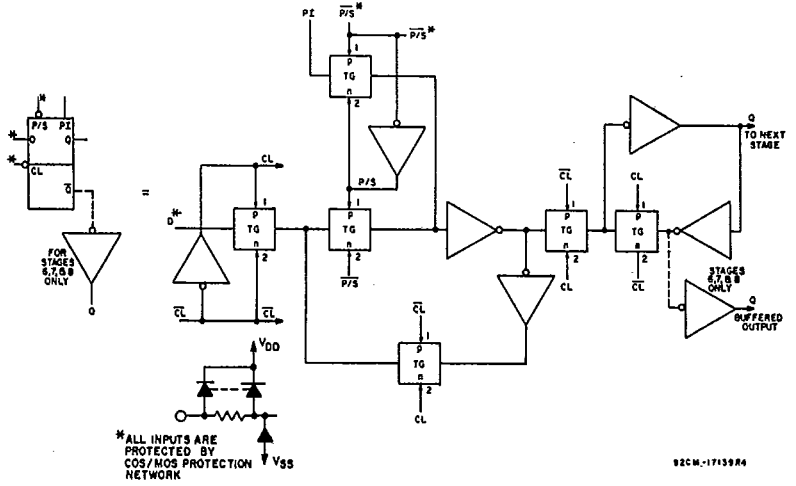
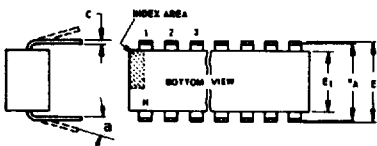
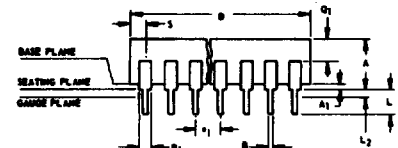


Fig. 10 - One typical stage and its equivalent detailed circuit.

Dimensional Outlines

Dual-In-Line Welded-Seal Ceramic Packages



- NOTES:**
Refer to Rules for Dimensioning (JEDEC Publication No. 95) for Axial Lead Product Outlines.
- When this device is supplied solder-dipped, the maximum lead thickness (narrow portion) will not exceed 0.013" (0.33 mm).
 - Leads within 0.005" (0.12 mm) radius of True Position (TP) at gauge plane with maximum material condition and unit installed.
 - e_A applies in zone L_2 when unit installed.
 - a applies to spread leads prior to installation.
 - N is the maximum quantity of lead positions.
 - N_1 is the quantity of allowable missing leads.

(D) SUFFIX (JEDEC MO-001-AD)
14-Lead Dual-In-Line Welded-Seal
Ceramic Package

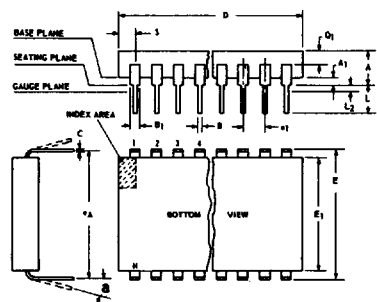
SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.120	0.160		3.05	4.06
A ₁	0.020	0.065		0.51	1.65
B	0.014	0.020		0.356	0.508
B ₁	0.060	0.065		1.27	1.65
C	0.008	0.012	1	0.204	0.304
D	0.745	0.770		18.93	19.55
E	0.300	0.325		7.62	8.25
E ₁	0.240	0.260		6.10	6.60
e_1	0.100 TP		2	2.54 TP	
e_A	0.300 TP		2, 3	7.62 TP	
L	0.125	0.150		3.18	3.81
L ₂	0.000	0.030		0.000	0.76
a	0°	15°	4	0°	15°
N	14		5	14	
N ₁	0		6	0	
Q ₁	0.050	0.085		1.27	2.15
S	0.065	0.090		1.66	2.28

92SS-4411R2

(D) SUFFIX (JEDEC MO-001-AE)
16-Lead Dual-In-Line Welded-Seal
Ceramic Package

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.120	0.160		3.05	4.06
A ₁	0.020	0.065		0.51	1.65
B	0.014	0.020		0.356	0.508
B ₁	0.035	0.065		0.89	1.65
C	0.008	0.012	1	0.204	0.304
D	0.745	0.785		18.93	19.93
E	0.300	0.325		7.62	8.25
E ₁	0.240	0.260		6.10	6.60
e_1	0.100 TP		2	2.54 TP	
e_A	0.300 TP		2, 3	7.62 TP	
L	0.125	0.150		3.18	3.81
L ₂	0.000	0.030		0.000	0.76
a	0°	15°	4	0°	15°
N	16		5	16	
N ₁	0		6	0	
Q ₁	0.050	0.085		1.27	2.15
S	0.015	0.060		0.39	1.52

92SS-4266R5



- NOTES:**
Refer to Rules for Dimensioning (JEDEC Publication No. 95) for Axial Lead Product Outlines.
- When this device is supplied solder-dipped, the maximum lead thickness (narrow portion) will not exceed 0.013" (0.33 mm).
 - Leads within 0.005" (0.12 mm) radius of True Position (TP) at gauge plane with maximum material condition and unit installed.
 - e_A applies in zone L_2 when unit installed.
 - a applies to spread leads prior to installation.
 - N is the maximum quantity of lead positions.
 - N_1 is the quantity of allowable missing leads.

(D) SUFFIX (JEDEC MO-015-AG)
24-Lead Dual-In-Line Welded-Seal
Ceramic Package

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.090	0.200		2.29	5.08
A ₁	0.020	0.070		0.51	1.78
B	0.015	0.020		0.381	0.508
B ₁	0.045	0.055		1.143	1.397
C	0.008	0.012	1	0.204	0.304
D	1.15	1.22		29.21	30.98
E	0.600	0.625		15.24	15.87
E ₁	0.480	0.520		12.20	13.20
e_1	0.100 TP		2	2.54 TP	
e_A	0.600 TP		2, 3	15.24 TP	
L	0.100	0.180		2.54	4.57
L ₂	0.000	0.030		0.00	0.76
a	0°	15°	4	0°	15°
N	24		5	24	
N ₁	0		6	0	
Q ₁	0.020	0.080		0.51	2.03
S	0.020	0.060		0.51	1.52

92CS-19948R4

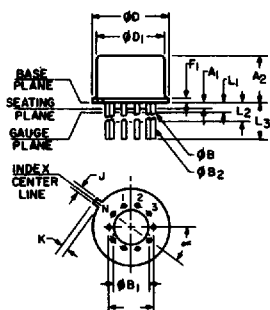
(D) SUFFIX (JEDEC MO-015-AH)
28-Lead Dual-In-Line Welded-Seal
Ceramic Package

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.090	0.200		2.29	5
A ₁	0	0.070	2	0	1.77
B	0.015	0.020		0.381	0.508
B ₁	0.015	0.065		0.39	1.39
C	0.008	0.012	1	0.204	0.304
D	1.380	1.420		35.06	36.06
E	0.600	0.625		15.24	15.87
E ₁	0.485	0.515		12.32	13.08
e_1	0.100 TP		2	2.54 TP	
e_A	0.600 TP		2, 3	15.24 TP	
L	0.100	0.200		2.6	5
L ₂	0	0.030		0	0.76
a	0°	15°	4	0°	15°
N	28		5	28	
N ₁	0		6	0	
Q ₁	0.020	0.070		0.51	1.77
S	0.040	0.070		1.02	1.77

92CM-20250R2

TO-5 Style Package

(T) SUFFIX (JEDEC MO-006-AG)
12-Lead Metal Package



92CS-19774

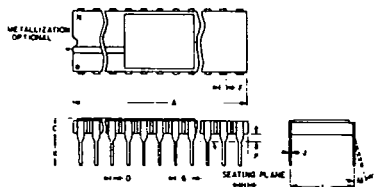
SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
a	0.230		2	5.84 TP	
A ₁	0	0		0	0
A ₂	0.165	0.185		4.19	4.70
ϕ_B	0.016	0.019	3	0.407	0.482
ϕ_{B1}	0	0		0	0
ϕ_{B2}	0.016	0.021	3	0.407	0.533
ϕ_D	0.335	0.370		8.51	9.39
ϕ_{D1}	0.305	0.335		7.75	8.50
F ₁	0.020	0.040		0.51	1.01
j	0.028	0.034		0.712	0.863
k	0.029	0.045	4	0.74	1.14
L ₁	0.000	0.050	3	0.00	1.27
L ₂	0.250	0.500	3	6.4	12.7
L ₃	0.500	0.562	3	12.7	14.27
a	30° TP			30° TP	
N	12		6	12	
N ₁	1		5	1	

NOTES:

- Refer to Rules for Dimensioning Axial Lead Product Outlines.
- Leads at gauge plane within 0.007" (0.178 mm) radius of True Position (TP) at maximum material condition.
- ϕ_B applies between L₁ and L₂. ϕ_{B2} applies between L₂ and 0.500" (12.70 mm) from seating plane. Diameter is uncontrolled in L₁ and beyond 0.500" (12.70 mm).
- Measure from Max. ϕ_D .
- N_1 is the quantity of allowable missing leads.
- N is the maximum quantity of lead positions.

Dimensional Outlines (Cont'd)

DUAL-IN-LINE SIDE-BRAZED CERAMIC PACKAGES



(D) SUFFIX
18-Lead Dual-In-Line
Side-Brazed Ceramic Package

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.890	0.915		22.606	23.241
C	-	0.200		-	5.080
D	0.015	0.021		0.381	0.533
F	0.054	REF.	1	1.371	REF.
G	0.100	BSC	1	2.54	BSC
H	0.035	0.065		0.889	1.651
J	0.008	0.012	3	0.203	0.304
K	0.125	0.150		3.175	3.810
L	0.290	0.310	2	7.366	7.874
M	0°	15°		0°	15°
P	0.025	0.045		0.635	1.143
N	18			18	

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(D) SUFFIX
22-Lead Dual-In-Line
Side-Brazed Ceramic Package

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	1.065	1.100		27.05	27.94
C	0.085	0.145		2.16	3.68
D	0.017	0.023		0.43	0.58
F	0.040	REF.	1	1.02	REF.
G	0.100	BSC	1	2.54	BSC
H	0.030	0.070		0.76	1.78
J	0.008	0.012	3	0.20	0.30
K	0.125	0.175		3.18	4.45
L	0.380	0.420	2	9.65	10.67
M	-	7°		-	7°
P	0.025	0.050		0.64	1.27
N	22			22	

92CS-25186R2

NOTES:

- Leads within 0.005" (0.13 mm) radius of True Position at maximum material condition.
- Dimension "L" to center of leads when formed parallel.
- When this device is supplied solder-dipped, the maximum lead thickness (narrow portion) will not exceed 0.013" (0.33 mm).

(D) SUFFIX
24-Lead Dual-In-Line
Side-Brazed Ceramic Package

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	1.180	1.220		29.98	30.98
C	0.085	0.145		2.16	3.68
D	0.015	0.023		0.39	0.58
F	0.040	REF.		1.02	REF.
G	0.100	BSC	1	2.54	BSC
H	0.030	0.070		0.77	1.77
J	0.008	0.012	3	0.21	0.30
K	0.125	0.175		3.18	4.44
L	0.580	0.620	2	14.74	15.74
M	-	7°		-	7°
P	0.025	0.050		0.64	1.27
N	24			24	

92CS-30968R1

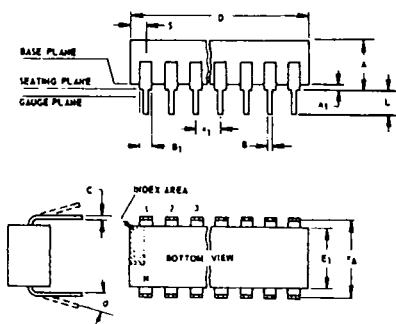
(D) SUFFIX
40-Lead Dual-In-Line
Side-Brazed Ceramic Package

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	1.980	2.020		50.30	51.30
C	0.095	0.155		2.43	3.93
D	0.017	0.023		0.43	0.58
F	0.050	REF.		1.27	REF.
G	0.100	BSC	1	2.54	BSC
H	0.030	0.070		0.76	1.78
J	0.008	0.012	3	0.20	0.30
K	0.125	0.175		3.18	4.45
L	0.580	0.620	2	14.74	15.74
M	-	7°		-	7°
P	0.025	0.050		0.64	1.27
N	40			40	

92CM-27029R2

Dual-In-Line Plastic and Frit-Seal Ceramic Packages

(E) SUFFIX (JEDEC MO-001-AN)
8-Lead Dual-In-Line Plastic
(Mini-DIP) Package



SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.155	0.200		3.94	5.08
A ₁	0.020	0.050		0.508	1.27
B	0.014	0.020		0.356	0.508
B ₁	0.035	0.065		0.889	1.65
C	0.008	0.012	1	0.203	0.304
D	0.370	0.400		9.40	10.16
E	0.300	0.325		7.62	8.25
E ₁	0.240	0.260		6.10	6.60
e ₁	0.100	TP	2	2.54	TP
e _A	0.300	TP	2, 3	7.62	TP
L	0.125	0.150		3.18	3.81
L ₂	0.000	0.030		0.000	0.762
a	0	15	4	0	15
N	8		5	8	
N ₁	0		6	0	
O ₁	0.040	0.075		1.02	1.90
S	0.015	0.060		0.381	1.52

92CS-24026 R1

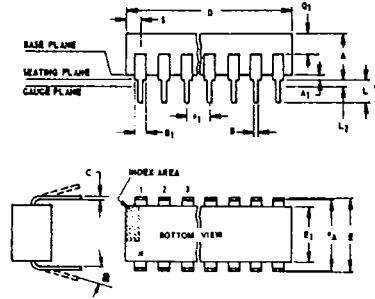
NOTES:

Refer to Rules for Dimensioning (JEDEC Publication No. 95) for Axial Lead Product Outlines.

- When this device is supplied solder-dipped, the maximum lead thickness (narrow portion) will not exceed 0.013".
- Leads within 0.005" (0.12 mm) radius of True Position (TP) at gauge plane with maximum material condition and unit installed.
- e_A applies in zone L₂ when unit installed.
- a applies to spread leads prior to installation.
- N is the maximum quantity of lead positions.
- N₁ is the quantity of allowable missing leads.

Dimensional Outlines (Cont'd)

Dual-In-Line Plastic and Frit-Seal Ceramic Packages (Cont'd)



NOTES:
 Refer to Rules for Dimensioning (JEDEC Publication No. 95) for Axial Lead Product Outlines.
 1. When this device is supplied solder dipped, the maximum lead thickness (narrow portion) will not exceed 0.013" (0.33 mm).
 2. Leads within 0.005" (0.12 mm) radius of True Position (TP) at gauge plane with maximum material condition and unit installed.
 3. eA applies in zone L2 when unit installed.
 4. a applies to spread leads prior to installation.
 5. N is the maximum quantity of lead positions.
 6. N1 is the quantity of allowable missing leads.

**(E) and (F) SUFFIXES (JEDEC MO-001-AB)
 14-Lead Dual-In-Line Plastic or Frit-Seal Ceramic Package**

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.155	0.200		3.94	5.08
A ₁	0.020	0.050		0.51	1.27
B	0.014	0.020		0.356	0.508
B ₁	0.050	0.065		1.27	1.65
C	0.008	0.012	1	0.204	0.304
D	0.745	0.770		18.93	19.55
E	0.300	0.325		7.62	8.25
E ₁	0.240	0.260		6.10	6.60
e ₁	0.100 TP		2	2.54 TP	
e _A	0.300 TP		2, 3	7.62 TP	
L	0.125	0.150		3.18	3.81
L ₂	0.000	0.030		0.000	0.76
a	0°	15°	4	0°	15°
N	14		5	14	
N ₁	0		6	0	
Q ₁	0.040	0.075		1.02	1.90
S	0.065	0.090		1.66	2.28

92SS-4296R3

**(E) and (F) SUFFIXES (JEDEC MO-001-AC)
 16-Lead Dual-In-Line Plastic or Frit-Seal Ceramic Package**

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.155	0.200		3.94	5.08
A ₁	0.020	0.050		0.51	1.27
B	0.014	0.020		0.356	0.508
B ₁	0.035	0.065		0.89	1.65
C	0.008	0.012	1	0.204	0.304
D	0.745	0.785		18.93	19.93
E	0.300	0.325		7.62	8.25
E ₁	0.240	0.260		6.10	6.60
e ₁	0.100 TP		2	2.54 TP	
e _A	0.300 TP		2, 3	7.62 TP	
L	0.125	0.150		3.18	3.81
L ₂	0.000	0.030		0.000	0.76
a	0°	15°	4	0°	15°
N	16		5	16	
N ₁	0		6	0	
Q ₁	0.040	0.075		1.02	1.90
S	0.015	0.060		0.39	1.52

92CM-15967R4

**(E) SUFFIX
 18-Lead Dual-In-Line Plastic Package**

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.155	0.200		3.94	5.08
A ₁	0.020	0.050		0.508	1.27
B	0.014	0.020		0.356	0.508
B ₁	0.035	0.065		0.89	1.65
C	0.008	0.012	1	0.204	0.304
D	0.845	0.885		21.47	22.47
E ₁	0.240	0.260		6.10	6.60
e ₁	0.100 TP		2	2.54 TP	
e _A	0.300 TP		2, 3	7.62 TP	
L	0.125	0.150		3.18	3.81
L ₂	0	0.030		0	0.762
a	0°	15°	4	0°	15°
N	18		5	18	
N ₁	0		6	0	
S	0.015	0.060		0.39	1.52

92CS-30630

**(E) SUFFIX
 22-Lead Dual-In-Line Plastic Package**

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.155	0.200		3.94	5.08
A ₁	0.020	0.050		0.508	1.27
B	0.015	0.020		0.381	0.508
B ₁	0.035	0.065		0.89	1.65
C	0.008	0.012	1	0.204	0.304
D		1.120			28.44
E	0.390	0.420		9.91	10.66
E ₁	0.345	0.355		8.77	9.01
e ₁	0.100 TP		2	2.54 TP	
e _A	0.400 TP		2, 3	10.16 TP	
L	0.125	0.150		3.18	3.81
L ₂	0	0.030		0	0.762
a	2°	15°	4	2°	15°
N	22		5	22	
N ₁	0		6	0	
Q ₁	0.055	0.085		1.40	2.15
S	0.015	0.060		0.381	1.27

92CS-30830

**(F) SUFFIX (JEDEC MO-001-AG)
 16-Lead Dual-In-Line Frit-Seal Ceramic Package**

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.165	0.210		4.20	5.33
A ₁	0.015	0.045		0.381	1.14
B	0.015	0.020		0.381	0.508
B ₁	0.045	0.070		1.15	1.77
C	0.009	0.011	1	0.229	0.279
D	0.750	0.795		19.05	20.19
E	0.295	0.325		7.50	8.25
E ₁	0.245	0.300		6.23	7.62
e ₁	0.100 TP		2	2.54 TP	
e _A	0.300 TP		2, 3	7.62 TP	
L	0.120	0.160		3.05	4.06
L ₂	0.000	0.030		0.000	0.76
a	2°	15°	4	2°	15°
N	16		5	16	
N ₁	0		6	0	
Q ₁	0.050	0.080		1.27	2.03
S	0.010	0.060		0.254	1.52

92CM-22284R1

**(E) and (F) SUFFIXES (JEDEC MO-015-AA)
 24-Lead Dual-In-Line Plastic or Frit-Seal Ceramic Package**

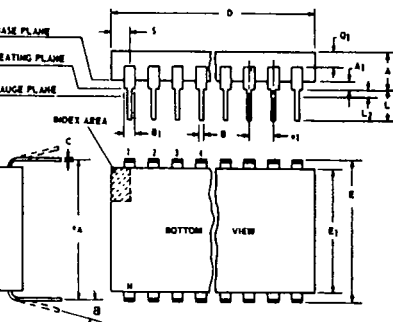
SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.120	0.250		3.10	6.30
A ₁	0.020	0.070		0.51	1.77
B	0.016	0.020		0.407	0.508
B ₁	0.028	0.070		0.72	1.77
C	0.008	0.012	1	0.204	0.304
D	1.20	1.29		30.48	32.76
E	0.600	0.625		15.24	15.87
E ₁	0.515	0.580		13.09	14.73
e ₁	0.100 TP		2	2.54 TP	
e _A	0.600 TP		2, 3	15.24 TP	
L	0.100	0.200		2.54	5.00
L ₂	0.000	0.030		0.00	0.76
a	0°	15°	4	0°	15°
N	24		5	24	
N ₁	0		6	0	
Q ₁	0.040	0.075		1.02	1.90
S	0.040	0.100		1.02	2.54

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**(E) SUFFIX
 40-Lead Dual-In-Line Plastic Package**

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.120	0.250		3.10	6.30
A ₁	0.020	0.070		0.51	1.77
B	0.016	0.020		0.407	0.508
B ₁	0.028	0.070		0.72	1.77
C	0.008	0.012	1	0.204	0.304
D	2.000	2.090		50.80	53.09
E ₁	0.515	0.580		13.09	14.73
e ₁	0.100 TP		2	2.54 TP	
e _A	0.600 TP		2, 3	15.24 TP	
L	0.100	0.200		2.54	5.00
L ₂	0.000	0.030		0.00	0.76
a	0°	15°	4	0°	15°
N	40		5	40	
N ₁	0		6	0	
Q ₁	0.065	0.095		1.66	2.41
S	0.040	0.100		1.02	2.54

92CS-30959



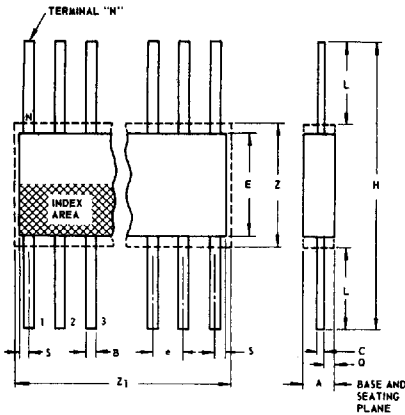
NOTES:
 Refer to Rules for Dimensioning (JEDEC Publication No. 95) for Axial Lead Product Outlines.
 1. When this device is supplied solder dipped, the maximum lead thickness (narrow portion) will not exceed 0.013".
 2. Leads within 0.005" (0.12 mm) radius of True Position (TP) at gauge plane with maximum material condition and unit installed.
 3. eA applies in zone L2 when unit installed.
 4. a applies to spread leads prior to installation.
 5. N is the maximum quantity of lead positions.
 6. N1 is the quantity of allowable missing leads.

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Dimensional Outlines (Cont'd)

Ceramic Flat Packs

**(K) SUFFIX (JEDEC MO-004-AF)
14-Lead**



SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.008	0.100		0.21	2.54
B	0.015	0.019	1	0.381	0.482
C	0.003	0.006	1	0.077	0.152
e	0.050 TP		2	1.27 TP	
E	0.200	0.300		5.1	7.6
H	0.600	1.000		15.3	25.4
L	0.150	0.350		3.9	8.8
N	14		3	14	
Q	0.005	0.050		0.13	1.27
S	0.000	0.050		0.00	1.27
Z	0.300		4	7.62	
Z ₁	0.400		4	10.16	

9288-4300R3

NOTES:

1. Refer to JEDEC Publication No. 95 for Rules for Dimensioning Peripheral Lead Outlines.
2. Leads within 0.005" (0.12 mm) radius of True Position (TP) at maximum material condition.
3. N is the maximum quantity of lead positions.
4. Z and Z₁ determine a zone within which all body and lead irregularities lie.

**(K) SUFFIX (JEDEC MO-004-AG)
16-Lead**

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.008	0.100		0.21	2.54
B	0.015	0.019	1	0.381	0.482
C	0.003	0.006	1	0.077	0.152
e	0.050 TP		2	1.27 TP	
E	0.200	0.300		5.1	7.6
H	0.600	1.000		15.3	25.4
L	0.150	0.350		3.9	8.8
N	16		3	16	
Q	0.005	0.050		0.13	1.27
S	0.000	0.025		0.00	0.63
Z	0.300		4	7.62	
Z ₁	0.400		4	10.16	

92CS-17271R3

**(K) SUFFIX
24-Lead**

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.075	0.120		1.91	3.04
B	0.018	0.022	1	0.458	0.558
C	0.004	0.007	1	0.102	0.177
e	0.050 TP		2	1.27 TP	
E	0.600	0.700		15.24	17.78
H	1.150	1.350		29.21	34.29
L	0.225	0.325		5.72	8.25
N	24		3	24	
Q	0.035	0.070		0.89	1.77
S	0.060	0.110	1	1.53	2.79
Z	0.700		4	17.78	
Z ₁	0.750		4	19.05	

92CS-19949R2

**(K) SUFFIX
28-Lead**

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.075	0.120		1.91	3.04
B	0.018	0.022	1	0.458	0.558
C	0.004	0.007	1	0.102	0.177
e	0.050 TP		2	1.27 TP	
E	0.600	0.700		15.24	17.78
H	1.150	1.350		29.21	34.29
L	0.225	0.325		5.72	8.25
N	28		3	28	
Q	0.035	0.070		0.89	1.77
S	0	0.060	1	0	1.53
Z	0.700		4	17.78	
Z ₁	0.750		4	19.05	

92CS-20972