

T-45-23-21

CD4024A Types

CMOS 7-Stage Binary Counter

With Buffered Reset

The RCA-CD4024A consists of an INPUT PULSE shaping circuit, RESET line driver circuitry, and seven binary counter stages. The counter is reset to "zero" by a high level on the RESET input. Each counter stage is a static master-slave flip-flop. The counter state is advanced one count on the negative-going transition of each INPUT PULSE.

These types are supplied in 14-lead hermetic dual-in-line ceramic packages (D and F suffixes), 14-lead dual-in-line plastic package (E suffix), 12-lead hermetic TO-5-style package (T suffix), 14-lead ceramic flat package (K suffix), and in chip form (H suffix).

Applications:

- Frequency-dividing circuits
- Time-delay circuits
- Counter control
- D/A counter and switch on one chip

MAXIMUM RATINGS, Absolute-Maximum Values:

STORAGE-TEMPERATURE RANGE (T_{stg})	...	-65 to +150°C
OPERATING-TEMPERATURE RANGE (T_A):		
PACKAGE TYPES (D, F, K, T, 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 $T_A = -55$ to +100°C (PACKAGE TYPES D, F, K, T)	...	500 mW
FOR $T_A = +100$ to +125°C (PACKAGE TYPES D, F, K, T)	...	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

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.

CHARACTERISTIC	VDD (V)	LIMITS				UNITS
		D, F, K, T, H Packages		E Package		
		Min.	Max.	Min.	Max.	
Supply-Voltage Range (For T _A = Full Package-Temperature Range)		3	12	3	12	V
Clock Pulse Width, t _W	5 10	330 125	— —	500 165	— —	ns
Clock Input Frequency, f _{CL}	5 10	dc dc	1.5 4	dc dc	1 3	MHz
Clock Rise or Fall Time, t _r CL, t _f CL	5 10	15 15	— —	15 15	— —	μs
Reset Pulse Width, t _W	5 10	500 300	— —	600 350	— —	ns

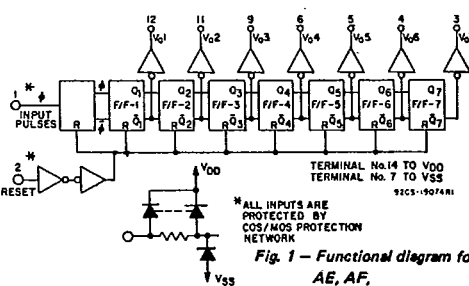


Fig. 1 - Functional diagram for CD4024AD, AE, AF.

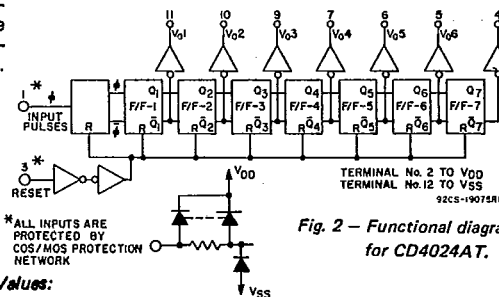
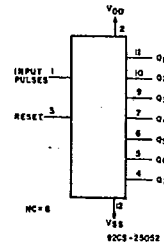
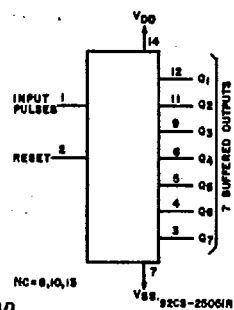


Fig. 2 - Functional diagram for CD4024AT.



Features:

- Medium-speed operation 7-MHz (typ.) input pulse rate at $V_{DD} - V_{SS} = 10$ V
- Low high-and-low level output impedance . . 700Ω and 500Ω (typ.), respectively at $V_{DD} - V_{SS} = 10$ V
- Fully static operation
- Common reset
- Quiescent current specified to 15 V
- Maximum input leakage current of 1 μA at 15 V (full package-temperature range)
- 1-V noise margin (full package-temperature range)

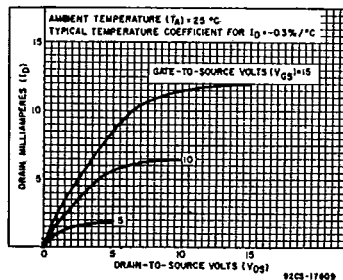
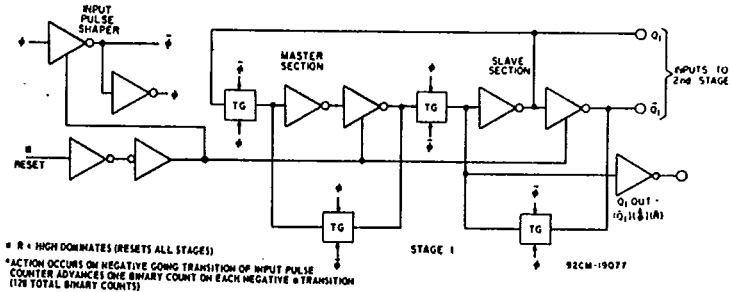


Fig. 3 - Typical output n-channel drain characteristics.

CD4024A Types

STATIC ELECTRICAL CHARACTERISTICS

Characteristic	Conditions			Limits at Indicated Temperatures (°C)									Units
				D, F, K, T, H Packages						E Package			
	V _O (V)	V _{IN} (V)	V _{DD} (V)	-55	+25		+125	-40	+25		+85		
					Typ.	Limit			Typ.	Limit			
Quiescent Device Current, I _Q Max.	—	—	5	5	0.3	5	300	50	0.5	50	700	μA	
	—	—	10	10	0.5	10	600	100	1	100	1400		
	—	—	15	50	1	50	2000	500	5	500	5000		
Output Voltage: Low-Level, V _{OL} High Level, V _{OH}	—	5	5	0 Typ.; 0.05 Max.									V
	—	10	10	0 Typ.; 0.05 Max.									
	—	0	5	4.95 Min.; 5 Typ.									V
	—	0	10	9.95 Min.; 10 Typ.									
Noise Immunity: Inputs Low, V _{NL} Inputs High, V _{NH}	4.2	—	5	1.5 Min.; 2.25 Typ.									V
	9	—	10	3 Min.; 4.5 Typ.									
	0.8	—	5	1.5 Min.; 2.25 Typ.									V
	1	—	10	3 Min.; 4.5 Typ.									
Noise Margin: Inputs Low, V _{NML} Inputs High, V _{NMH}	4.5	—	5	1 Min.									V
	9	—	10	1 Min.									
	0.5	—	5	1 Min.									V
	1	—	10	1 Min.									
Output Drive Current: n-Channel (Sink), I _{DN} Min. p-Channel (Source) I _{DP} Min.	0.5	—	5	0.31	0.5	0.25	0.175	0.15	0.5	0.12	0.095	mA	
	0.5	—	10	0.62	1	0.5	0.35	0.31	1	0.25	0.2		
	4.5	—	5	-0.19	-0.3	-0.15	-0.105	-0.145	-0.3	-0.12	-0.095		
	9.5	—	10	-0.45	-0.7	-0.35	-0.25	-0.31	-0.7	-0.25	-0.2		
Input Leakage Current, I _{IL} , I _{IH}	Any Input	—	15	±10 ⁻⁵ Typ.; ±1 Max.									μA



EQUATIONS FOR STAGES 2 TO 7

$$\begin{aligned} Q_{2OUT} &= (\bar{Q}_1 \times Q_1) \times (\bar{Q}_2 \times Q_2) \\ Q_{3OUT} &= (\bar{Q}_2 \times Q_2) \times (\bar{Q}_3 \times Q_3) \\ Q_{4OUT} &= (\bar{Q}_3 \times Q_3) \times (\bar{Q}_4 \times Q_4) \\ Q_{5OUT} &= (\bar{Q}_4 \times Q_4) \times (\bar{Q}_5 \times Q_5) \\ Q_{6OUT} &= (\bar{Q}_5 \times Q_5) \times (\bar{Q}_6 \times Q_6) \\ Q_{7OUT} &= (\bar{Q}_6 \times Q_6) \times (\bar{Q}_7 \times Q_7) \end{aligned}$$

Fig. 7 — Logic block diagram (pulse shaper and 1 binary stage).

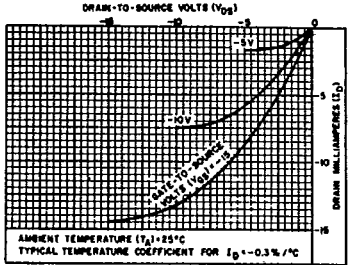


Fig. 4 — Typical output p-channel drain characteristics.

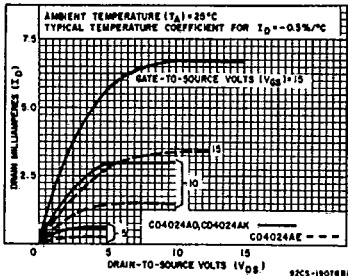


Fig. 5 — Minimum output n-channel drain characteristics.

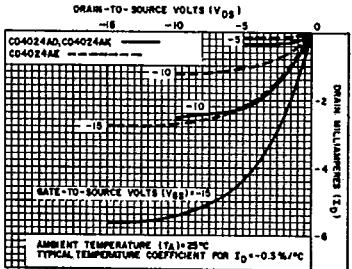


Fig. 6 — Minimum output p-channel drain characteristics.

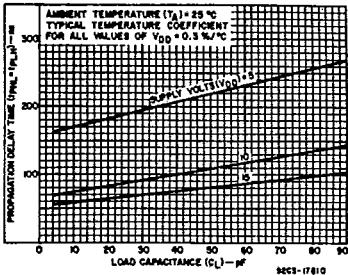


Fig. 8 — Typical propagation delay time vs. CL.

CD4024A Types

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

CHARACTERISTIC	TEST CONDITIONS	LIMITS						UNITS	
		V _{DD} (V)	D, F, K, T, H Packages			E Package			
			Min.	Typ.	Max.	Min.	Typ.		Max.
φ INPUT OPERATION									
Propagation Delay Time; t _{PLH} , t _{PHL}		5	—	175	350	—	175	400	ns
		10	—	80	125	—	80	150	
Transition Time; t _{THL} , t _{TLH}		5	—	175	225	—	175	250	ns
		10	—	80	125	—	80	150	
Maximum Pulse Input Frequency, f _φ		5	1.5	2.5	—	1	2.5	—	MHz
		10	4	7	—	3	7	—	
Minimum Input Pulse Width, t _W		5	—	200	330	—	200	500	ns
		10	—	140	125	—	140	165	
Input Pulse Rise & Fall Time, t _{rφ} , t _{fφ}		5	—	—	15	—	—	15	μs
		10	—	—	10	—	—	10	
Average Input Capacitance, C _i	Any Input		—	5	—	—	5	—	pF
RESET OPERATION									
Propagation Delay Time; T _{PLH} , T _{PHL}		5	—	600	700	—	500	800	ns
		10	—	250	350	—	250	400	
Minimum Reset Pulse Width, t _W		5	—	375	500	—	375	600	ns
		10	—	200	300	—	200	350	

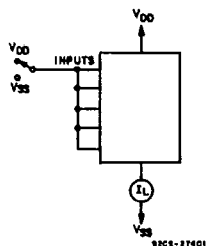
* Propagation delay time is from input pulse to Q_1 output.

Fig. 12 - Quiescent device current test circuit.

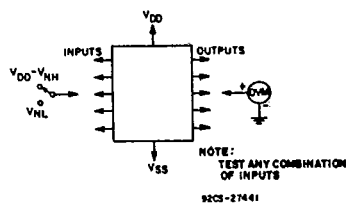


Fig. 13 - Noise-immunity test circuit.

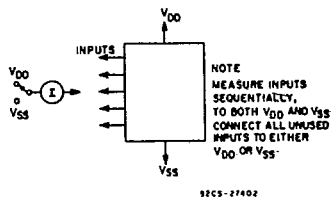


Fig. 14 - Input-leakage-current test circuit.

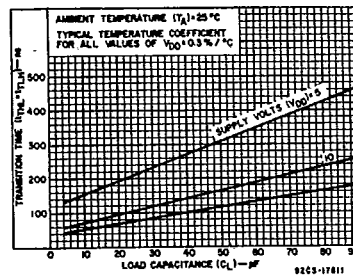
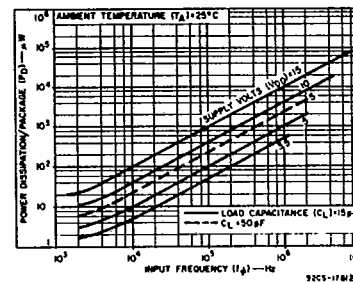
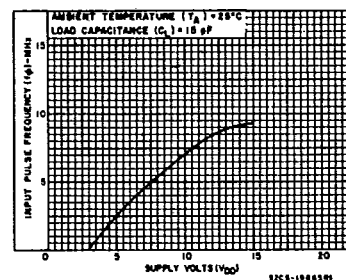
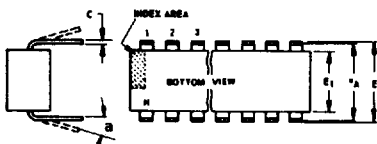
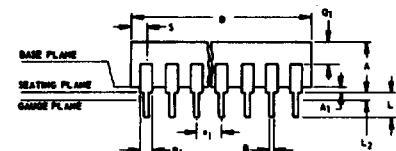
Fig. 9 - Typical transition time vs. C_L .

Fig. 10 - Typical dissipation characteristics.

Fig. 11 - Typical input pulse frequency vs. V_{DD} .

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 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.

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

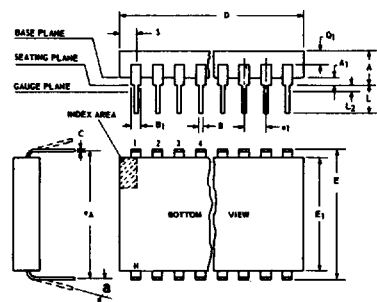
SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.120	0.160		3.05	4.06
A ₁	0.020	0.065		0.51	1.65
B	0.014	0.020		0.356	0.508
B ₁	0.060	0.065		1.27	1.65
C	0.008	0.012	1	0.204	0.304
D	0.745	0.770		18.93	19.55
E	0.300	0.325		7.62	8.25
E ₁	0.240	0.260		6.10	6.60
e ₁	0.100 TP		2	2.54 TP	
e _A	0.300 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 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.

(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

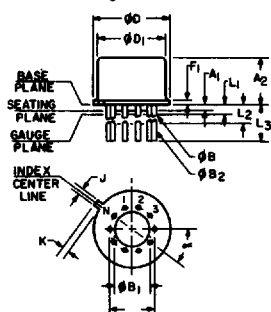
(D) SUFFIX (JEDEC MO-015-AH)
28-Lead Dual-In-Line Welded-Seal
Ceramic Package

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.090	0.200		2.29	5.08
A ₁	0.020	0.070	2	0.51	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		2.54	5.08
L ₂	0.000	0.030		0.00	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

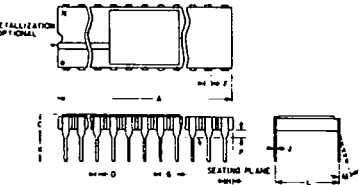
SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
a	0.230		2	5.84 TP	
A ₁	0	0		0	0
A ₂	0.165	0.185		4.19	4.70
ØB	0.016	0.019	3	0.407	0.482
ØB ₁	0	0		0	0
ØB ₂	0.016	0.021	3	0.407	0.533
ØD	0.335	0.370		8.51	9.39
ØD ₁	0.305	0.335		7.75	8.50
F ₁	0.020	0.040		0.51	1.01
J	0.028	0.034		0.712	0.863
k	0.029	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.
- ØB applies between L₁ and L₂. ØB₂ 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. ØD.
- N₁ 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



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

(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	

92CS-27231R1

(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-26186R2

(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-30986R1

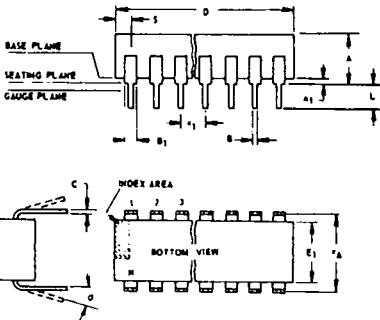
(D) SUFFIX
40-Lead Dual-In-Line
Side-Brazed Ceramic Package

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



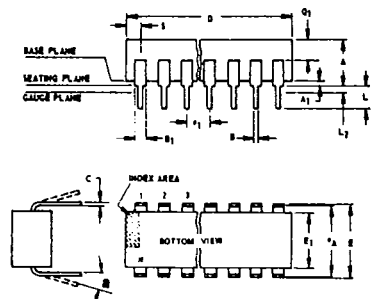
SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.155	0.200		3.94	5.08
A ₁	0.020	0.050		0.508	1.27
B	0.014	0.020		0.356	0.508
B ₁	0.035	0.065		0.889	1.65
C	0.008	0.012	1	0.203	0.304
D	0.370	0.400		9.40	10.16
E	0.300	0.325		7.62	8.25
E ₁	0.240	0.260		6.10	6.60
e ₁	0.100	TP	2	2.54	TP
e _A	0.300	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.
- 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. e_A 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.

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.

- 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_1 applies in zone L₂ 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.

(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	0.060		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
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

92CS26938R2

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

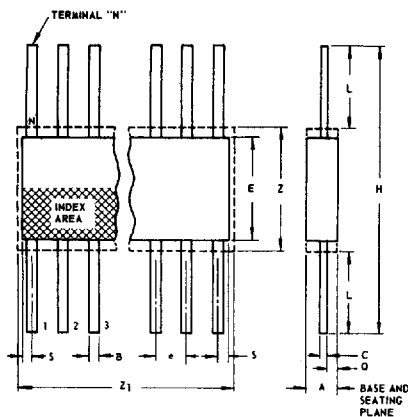
SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.120	0.250		3.10	6.30
A ₁	0.020	0.070		0.51	1.77
B	0.016	0.020		0.407	0.508
B ₁	0.028	0.070		0.72	1.77
C	0.008	0.012	1	0.204	0.304
D	2.000	2.090		50.80	53.09
E ₁	0.515	0.580		13.09	14.73
e_1	0.100 TP		2	2.54 TP	
e_A	0.600 TP		2, 3	15.24 TP	
L	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

T-90-20

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	

92S8-4300R3

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