

T-52-13-07

Preliminary Data

CD22105, CD22105A

CMOS Four-Digit LCD Decoder-Drivers

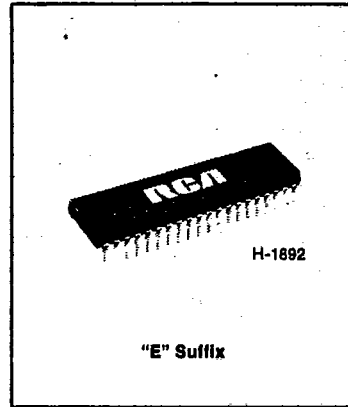
6-V Rating

Features

- 6-V supply-voltage rating
- No external components necessary
- 4-digit segment drive capability
- Backplane input/output allows synchronization for cascading devices to drive more digits
- Direct microprocessor interface
- Decodes binary into hexadecimal (CD22105) and decimal (CD22105A) outputs

Applications

- Microprocessor-controlled digital meters and calculators
- General-purpose displays
- Microprocessor-controlled automotive dashboard displays
- Microprocessor appliance control panels



"E" Suffix

The RCA-CD22105 types are non-multiplexed, four-digit, seven-segment, liquid-crystal display decoder-drivers.

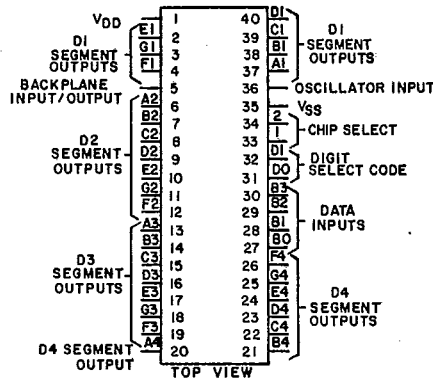
The CD22105 types contain all the circuitry necessary to drive conventional liquid-crystal displays (no external components required). Outputs are four sets of seven-segment driver signals and a backplane driver signal. The backplane signal, derived from an on-board free-running oscillator, is common to all four-digit displays.

The backplane and segment drives are designed so that p and n channels have the same ON resistances and thus equal rise and fall times. This equality eliminates any DC component, thereby maximizing display life. In addition to feeding the internal display drivers, the backplane signal can also be used as a master to drive a number of slave devices. The number of slaved devices should be limited to the load that keeps the backplane rise and fall times from exceeding 5  $\mu$ s. If this limit is to be exceeded, the master backplane drivers should be disabled (by connecting pin 36, the oscillator input, to  $V_{SS}$ ) and pin 5 should be fed from an external oscillator and all devices slaved to it. The maximum frequency of the external signal should be 125 Hz at room temperatures.

The on-board oscillator, which operates at 16 kHz when free-running (pin 36 floating), provides a backplane signal whose frequency is approximately 125 Hz. This frequency can be reduced by connecting an external capacitor to pin 36. Plots of backplane frequency vs. supply voltage at various values of external capacitance are shown in Fig. 3. The oscillator may be overdriven by an external signal but care must be taken to keep the lower voltage level above  $V_{SS}$  by at least 20 per cent of  $V_{DD}$  (for  $V_{DD}=5$  V the signal should oscillate between +1 and +5 volts). This precaution prevents the backplane driver from being disabled, a condition that would present a DC component to the LCD display. A signal swinging from rail-to-rail can also be used to overdrive the oscillator but in this case the duty cycle should be such that the lower portion of the signal must be less than one-microsecond duration (the backplane disable sensing circuit will not respond to signals of this duration).

A four-bit data-input latch and a two-bit select-code latch under the control of two chip-select inputs permit interfacing with a microprocessor. This device simplifies designing a seven-segment display into a microprocessor system, without requiring extensive ROM or CPU time for decoding and display updating. The four-bit binary input is decoded by means of a PROM into a seven-segment hexadecimal output for the CD22105 type and into a decimal display for the CD22105A type. These types are pin-compatible with the Intersil ICM7211MIPL and ICM7211AMIPL, respectively.

The CD22105 types are supplied in the 40-lead dual-in-line plastic (E suffix) package.



92CS-32932R1

CD22105, CD22105A Terminal Assignment

**CD22105, CD22105A**

**MAXIMUM RATINGS, Absolute-Maximum Values:**

DC SUPPLY-VOLTAGE RANGE, (V<sub>DD</sub>)  
 (Voltages referenced to V<sub>SS</sub> Terminal) ..... -0.3 to +6.5 V

INPUT VOLTAGE RANGE, ALL INPUTS ..... -0.3 to V<sub>DD</sub> +0.3 V

DC INPUT CURRENT, ANY ONE INPUT\* ..... ±10 mA

POWER DISSIPATION PER PACKAGE (P<sub>D</sub>):

For T<sub>A</sub> = -20 to +60°C ..... 500 mW

For T<sub>A</sub> = +60 to +70°C ..... Derate Linearly at 12 mW/°C to 380 mW

DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR T<sub>A</sub> = FULL PACKAGE-TEMPERATURE RANGE ..... 100 mW

OPERATING-TEMPERATURE RANGE (T<sub>A</sub>) ..... -20 to +70°C

STORAGE TEMPERATURE RANGE (T<sub>stg</sub>) ..... -55 to +125°C

LEAD TEMPERATURE (DURING SOLDERING):

At distance 1/16 ± 1/32 in. (1.59 ± 0.79 mm) from case for 10 s max. .... +265°C

\*Pin 36 limited to ±5 mA.

**STATIC ELECTRICAL CHARACTERISTICS**

T<sub>A</sub> = 25°C, V<sub>DD</sub> = 5 V, V<sub>SS</sub> = 0 V

CHARACTERISTIC	SYMBOL	CONDITIONS	LIMITS			UNITS
			MIN.	TYP.	MAX.	
Operating Supply Voltage Range	V <sub>DD</sub>	V <sub>SS</sub> = 0 V	3	5	6	V
Operating Current	I <sub>OP</sub>	Display Operating	—	10	50	μA
Oscillator Input Current	I <sub>OL</sub> , I <sub>OH</sub>	Pin 36	—	±2	±10	μA
Segment Rise and Fall Time	t <sub>rs</sub> , t <sub>fs</sub>	C <sub>L</sub> = 200 pF	—	0.5	—	μs
Backplane Rise and Fall Time	t <sub>rs</sub> , t <sub>fs</sub>	C <sub>L</sub> = 5000 pF	—	1.5	—	μs
Oscillator Frequency	f <sub>OSC</sub>	Pin 36 Floating	—	16	—	kHz
Backplane Frequency	f <sub>BP</sub>	Pin 36 Floating	—	125	—	Hz
Input High Voltage	V <sub>IH</sub>		3.5	—	—	V
Input Low Voltage	V <sub>IL</sub>		—	—	1.5	V
Input Leakage Current	I <sub>IL</sub>	Pins 27-34	—	±0.01	±1	μA
Input Capacitance	C <sub>I</sub>	Pins 27-34	—	5	—	pF
Backplane Input Leakage	I <sub>IL(BP)</sub>	Pin 5 with Pin 36 @ V <sub>SS</sub>	—	±0.01	±1	μA
Backplane Input Capacitance	C <sub>IL(BP)</sub>		—	200	—	pF

**DYNAMIC ELECTRICAL CHARACTERISTICS**

T<sub>A</sub> = 25°C, V<sub>DD</sub> = 5 V, V<sub>SS</sub> = 0 V

CHARACTERISTIC	SYMBOL	CONDITIONS	TYP. VALUES	UNITS
Chip-Select Active Pulse Width	t <sub>CSA</sub>	See Timing Diagram	100	ns
Data Setup Time	t <sub>DSM</sub>	See Timing Diagram	50	ns
Data Hold Time	t <sub>DHM</sub>	See Timing Diagram	25	ns
Inter-Chip Select Time	t <sub>CS</sub>	See Timing Diagram	1	μs

T-52-13-07  
 CD22105, CD22105A

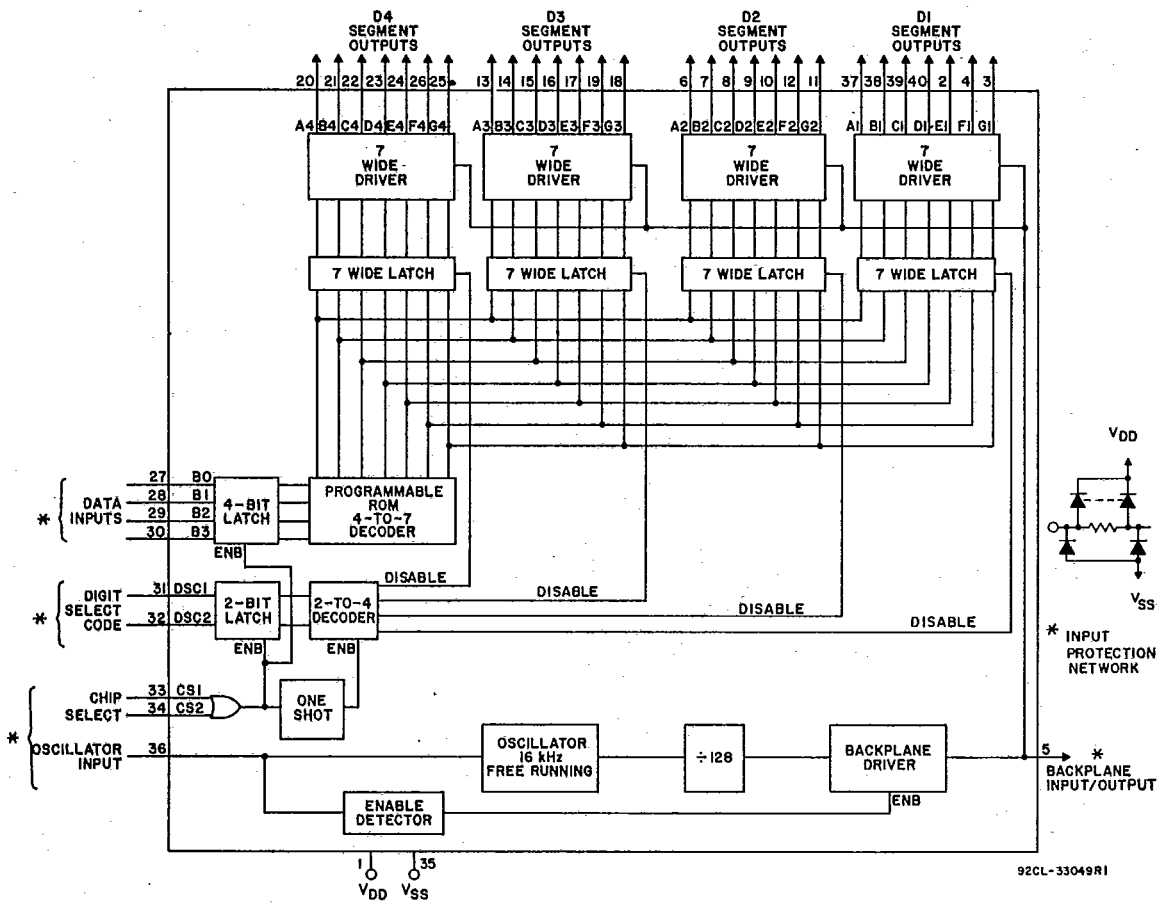


Fig. 1 - Block diagram of CD22105 and CD22105A.

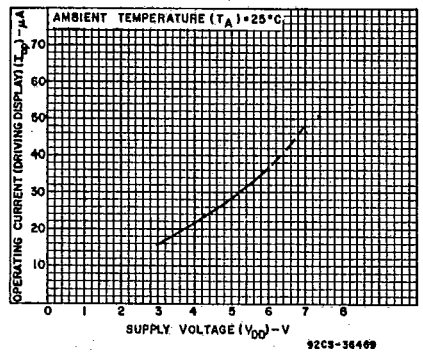


Fig. 2 - Typical operating current as a function of supply voltage.

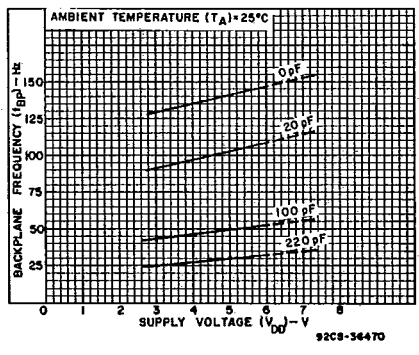
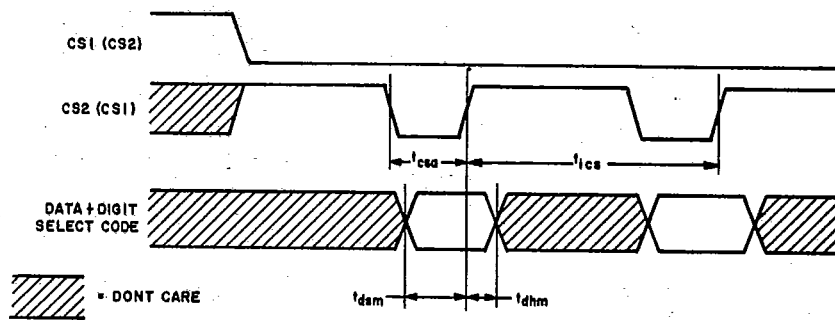


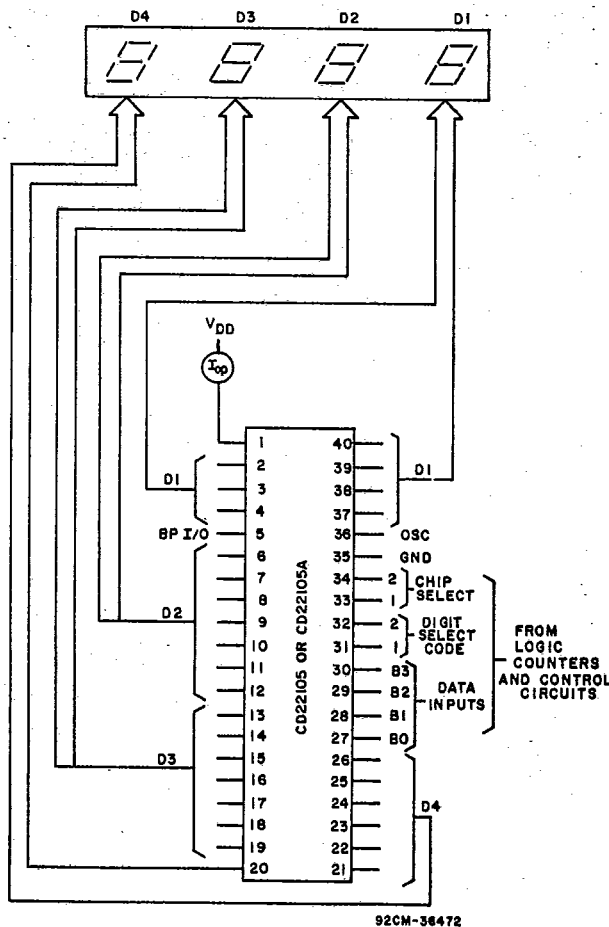
Fig. 3 - Typical backplane frequency as a function of supply voltage and external capacitance on pin 36.

CD22105, CD22105A



92CM-36474

Fig. 4 - CD22105, CD22105A timing diagram.



92CM-36472

Fig. 5 - Test circuit.

Table I — Output Codes

Binary Input B3 B2 B1 B0	Display	
	Hexadecimal CD22105	Decimal CD22105A
0 0 0 0	0	0
0 0 0 1	1	1
0 0 1 0	2	2
0 0 1 1	3	3
0 1 0 0	4	4
0 1 0 1	5	5
0 1 1 0	6	6
0 1 1 1	7	7
1 0 0 0	8	8
1 0 0 1	9	9
1 0 1 0	H	-
1 0 1 1	E	E
1 1 0 0	L	H
1 1 0 1	S	L
1 1 1 0	F	P
1 1 1 1	F	(BLANK)

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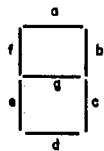
CHIP-SELECT TRUTH TABLE

Pins		Function
33	34	
0	0	New Inputs from $\mu$ P are written into input latches
0	1	Inputs from $\mu$ P are latched in input latches, decoded, and passed through selected (1 of 4) output latch to update selected digit
1	0	
1	1	

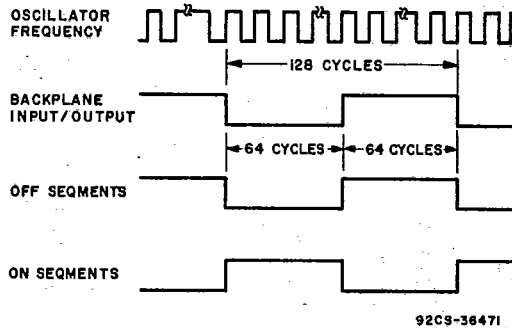
DIGIT SELECTION TRUTH TABLE

Pins		Digit Selected
31	32	
1	1	D1 (LSD)
0	1	D2
1	0	D3
0	0	D4 (MSD)

DISPLAY SEGMENTS



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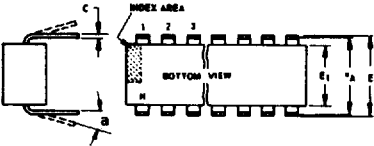
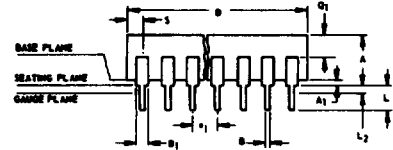


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Fig. 6 - Display waveforms.

## 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

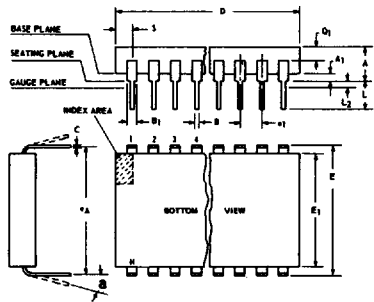
SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.120	0.160		3.05	4.06
A <sub>1</sub>	0.020	0.065		0.51	1.65
B	0.014	0.020		0.356	0.508
B <sub>1</sub>	0.060	0.065		1.27	1.65
C	0.008	0.012	1	0.204	0.304
D	0.745	0.770		18.93	19.55
E	0.300	0.325		7.62	8.25
E <sub>1</sub>	0.240	0.260		6.10	6.60
$e_1$	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 <sub>2</sub>	0.000	0.030		0.000	0.76
a	0°	15°	4	0°	15°
N	14		5	14	
N <sub>1</sub>	0		6	0	
Q <sub>1</sub>	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 <sub>1</sub>	0.020	0.065		0.51	1.65
B	0.014	0.020		0.356	0.508
B <sub>1</sub>	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 <sub>1</sub>	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 <sub>2</sub>	0.000	0.030		0.000	0.76
a	0°	15°	4	0°	15°
N	16		5	16	
N <sub>1</sub>	0		6	0	
Q <sub>1</sub>	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 <sub>1</sub>	0.020	0.070		0.51	1.78
B	0.015	0.020		0.381	0.508
B <sub>1</sub>	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 <sub>1</sub>	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 <sub>2</sub>	0.000	0.030		0.00	0.76
a	0°	15°	4	0°	15°
N	24		5	24	
N <sub>1</sub>	0		6	0	
Q <sub>1</sub>	0.020	0.080		0.51	2.03
S	0.020	0.060		0.51	1.52

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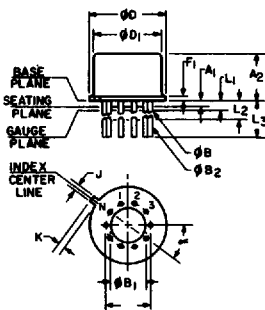
(D) SUFFIX (JEDEC MO-015-AH)  
28-Lead Dual-In-Line Welded-Seal Ceramic Package

SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.090	0.200		2.29	5
A <sub>1</sub>	0	0.070	2	0	1.77
B	0.015	0.020		0.381	0.508
B <sub>1</sub>	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 <sub>1</sub>	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 <sub>2</sub>	0	0.030		0	0.76
a	0°	15°	4	0°	15°
N	28		5	28	
N <sub>1</sub>	0		6	0	
Q <sub>1</sub>	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



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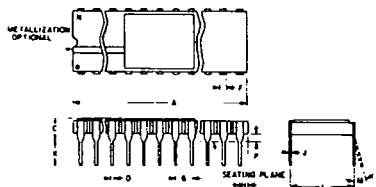
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	MIN.	MAX.		MIN.	MAX.
a	0.230		2	5.84 TP	
A <sub>1</sub>	0	0		0	0
A <sub>2</sub>	0.165	0.185		4.19	4.70
$\phi B$	0.016	0.019	3	0.407	0.482
$\phi B_1$	0	0		0	0
$\phi B_2$	0.016	0.021	3	0.407	0.533
$\phi D$	0.335	0.370		8.51	9.39
$\phi D_1$	0.305	0.335		7.75	8.50
F <sub>1</sub>	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 <sub>1</sub>	0.000	0.050	3	0.00	1.27
L <sub>2</sub>	0.250	0.500	3	6.4	12.7
L <sub>3</sub>	0.500	0.562	3	12.7	14.27
a	30° TP			30° TP	
N	12		6	12	
N <sub>1</sub>	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.
- $\phi B$  applies between L<sub>1</sub> and L<sub>2</sub>.  $\phi B_2$  applies between L<sub>2</sub> and 0.500" (12.70 mm) from seating plane. Diameter is uncontrolled in L<sub>1</sub> and beyond 0.500" (12.70 mm).
- Measure from Max.  $\phi D$ .
- $N_1$  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

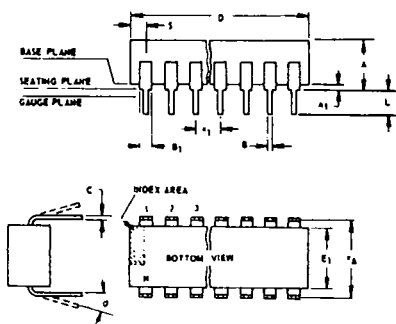
(D) SUFFIX  
40-Lead Dual-In-Line  
Side-Brazed Ceramic Package

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 <sub>1</sub>	0.020	0.050		0.508	1.27
B	0.014	0.020		0.356	0.508
B <sub>1</sub>	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 <sub>1</sub>	0.240	0.260		6.10	6.60
e <sub>1</sub>	0.100	TP	2	2.54	TP
e <sub>A</sub>	0.300	TP	2, 3	7.62	TP
L	0.125	0.150		3.18	3.81
L <sub>2</sub>	0.000	0.030		0.000	0.762
a	0	15	4	0	15
N	8		5	8	
N <sub>1</sub>	0		6	0	
O <sub>1</sub>	0.040	0.075		1.02	1.90
S	0.015	0.060		0.381	1.52

92CS-24026 R1

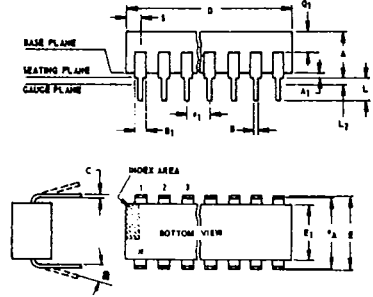
NOTES:

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<sub>A</sub> applies in zone L<sub>2</sub> when unit installed.
- a applies to spread leads prior to installation.
- N is the maximum quantity of lead positions.
- N<sub>1</sub> 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
A1	0.020	0.050		0.51	1.27
B	0.014	0.020		0.356	0.508
B1	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
E1	0.240	0.260		6.10	6.60
e1	0.100 TP		2	2.54 TP	
eA	0.300 TP		2, 3	7.62 TP	
L	0.125	0.150		3.18	3.81
L2	0.000	0.030		0.000	0.76
a	0°	15°	4	0°	15°
N	14		5	14	
N1	0		6	0	
Q1	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
A1	0.020	0.050		0.51	1.27
B	0.014	0.020		0.356	0.508
B1	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
E1	0.240	0.260		6.10	6.60
e1	0.100 TP		2	2.54 TP	
eA	0.300 TP		2, 3	7.62 TP	
L	0.125	0.150		3.18	3.81
L2	0.000	0.030		0.000	0.76
a	0°	15°	4	0°	15°
N	16		5	16	
N1	0		6	0	
Q1	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
A1	0.020	0.050		0.508	1.27
B	0.014	0.020		0.356	0.508
B1	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
E1	0.240	0.260		6.10	6.60
e1	0.100 TP		2	2.54 TP	
eA	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	
N1	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
A1	0.020	0.050		0.508	1.27
B	0.015	0.020		0.381	0.508
B1	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
E1	0.345	0.355		8.77	9.01
e1	0.100 TP		2	2.54 TP	
eA	0.400 TP		2, 3	10.16 TP	
L	0.125	0.150		3.18	3.81
L2	0	0.030		0	0.762
a	2°	15°	4	2°	15°
N	22		5	22	
N1	0		6	0	
Q1	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
A1	0.015	0.045		0.381	1.14
B	0.015	0.020		0.381	0.508
B1	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
E1	0.245	0.300		6.23	7.62
e1	0.100 TP		2	2.54 TP	
eA	0.300 TP		2, 3	7.62 TP	
L	0.120	0.160		3.05	4.06
L2	0.000	0.030		0.000	0.76
a	2°	15°	4	2°	15°
N	16		5	16	
N1	0		6	0	
Q1	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**

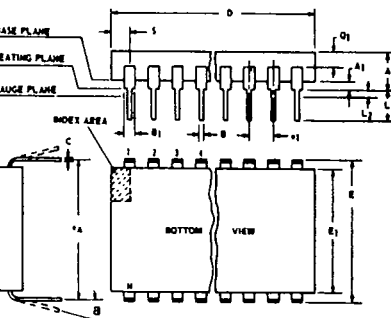
SYMBOL	INCHES		NOTE	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	0.120	0.250		3.10	6.30
A1	0.020	0.070		0.51	1.77
B	0.016	0.020		0.407	0.508
B1	0.028	0.070		0.72	1.77
C	0.008	0.012	1	0.204	0.304
D	1.20	1.29		30.48	32.76
E	0.600	0.625		15.24	15.87
E1	0.515	0.580		13.09	14.73
e1	0.100 TP		2	2.54 TP	
eA	0.600 TP		2, 3	15.24 TP	
L	0.100	0.200		2.54	5.00
L2	0.000	0.030		0.00	0.76
a	0°	15°	4	0°	15°
N	24		5	24	
N1	0		6	0	
Q1	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
A1	0.020	0.070		0.51	1.77
B	0.016	0.020		0.407	0.508
B1	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
E1	0.515	0.580		13.09	14.73
e1	0.100 TP		2	2.54 TP	
eA	0.600 TP		2, 3	15.24 TP	
L	0.100	0.200		2.54	5.00
L2	0.000	0.030		0.00	0.76
a	0°	15°	4	0°	15°
N	40		5	40	
N1	0		6	0	
Q1	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.

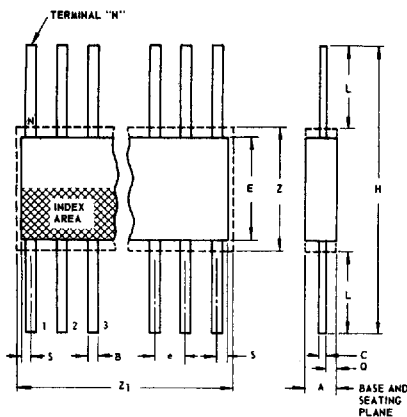


T-90-20

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 <sub>1</sub>	0.400		4	10.16	

928S-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 Z<sub>1</sub> 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 <sub>1</sub>	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 <sub>1</sub>	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 <sub>1</sub>	0.750		4	19.05	

92CS-20972