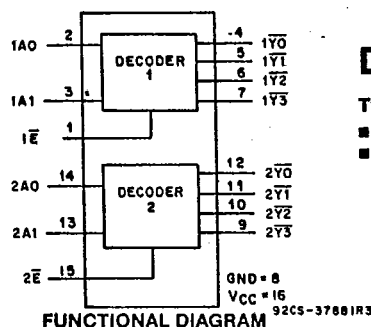


Technical Data

CD54/74AC139
CD54/74ACT139

T-67-21-55



Dual 2-to-4-Line Decoder/Demultiplexer

Type Features:

- Buffered inputs
- Typical propagation delay:
5.4 ns @ $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$

The RCA CD54/74AC139 and CD54/74ACT139 dual 2-to-4-line decoders/demultiplexers use the RCA ADVANCED CMOS technology. These devices contain two independent binary to one-of-four decoders, each with a single active-LOW enable input ($\overline{1E}$ or $\overline{2E}$). Data on the select inputs (1A0 and 1A1 or 2A0 and 2A1) cause one of the four normally HIGH outputs to go LOW.

If the enable input is HIGH, all four outputs remain HIGH. For demultiplexer operation, the enable input is the data input. The enable input also functions as a chip select when these devices are cascaded.

The CD74AC139 and CD74ACT139 are supplied in 16-lead dual-in-line plastic packages (E suffix) and in 16-lead dual-in-line small-outline plastic packages (M suffix). Both package types are operable over the following temperature ranges: Commercial (0 to 70°C); Industrial (-40 to $+85^\circ\text{C}$); and Extended Industrial/Military (-55 to $+125^\circ\text{C}$).

The CD54AC139 and CD54ACT139, available in chip form (H suffix), are operable over the -55 to $+125^\circ\text{C}$ temperature range.

Family Features:

- Exceeds 2-kV ESD Protection - MIL-STD-883, Method 3015
- SCR-Latchup-resistant CMOS process and circuit design
- Speed of bipolar FAST[®]/AS/S with significantly reduced power consumption
- Balanced propagation delays
- AC types feature 1.5-V to 5.5-V operation and balanced noise immunity at 30% of the supply.
- $\pm 24\text{-mA}$ output drive current
 - Fanout to 15 FAST[®] ICs
 - Drives 50-ohm transmission lines

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TRUTH TABLE

Enable	INPUTS		OUTPUTS			
	A1	A0	$\overline{Y3}$	$\overline{Y2}$	$\overline{Y1}$	$\overline{Y0}$
L	L	L	H	H	H	L
L	L	H	H	H	L	H
L	H	L	H	L	H	H
L	H	H	L	H	H	H
H	X	X	H	H	H	H

X = Don't care

File Number 1953

T-67-21-55

CD54/74AC139

CD54/74ACT139

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE (V_{CC})	-0.5 to 6 V
DC INPUT DIODE CURRENT, I_{IK} (for $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V)	± 20 mA
DC OUTPUT DIODE CURRENT, I_{OK} (for $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V)	± 50 mA
DC OUTPUT SOURCE OR SINK CURRENT per Output Pin, I_O (for $V_O > -0.5$ V or $V_O < V_{CC} + 0.5$ V)	± 50 mA
DC V_{CC} or GROUND CURRENT (I_{CC} or I_{GND})	± 100 mA*
POWER DISSIPATION PER PACKAGE (P_D):	
For $T_A = -55$ to $+100^\circ\text{C}$ (PACKAGE TYPE E)	500 mW
For $T_A = +100$ to $+125^\circ\text{C}$ (PACKAGE TYPE E)	Derate Linearly at 8 mW/ $^\circ\text{C}$ to 300 mW
For $T_A = -55$ to $+70^\circ\text{C}$ (PACKAGE TYPE M)	400 mW
For $T_A = +70$ to $+125^\circ\text{C}$ (PACKAGE TYPE M)	Derate Linearly at 6 mW/ $^\circ\text{C}$ to 70 mW
OPERATING-TEMPERATURE RANGE (T_A)	-55 to $+125^\circ\text{C}$
STORAGE TEMPERATURE (T_{stg})	-65 to $+150^\circ\text{C}$
LEAD TEMPERATURE (DURING SOLDERING):	
At distance $1/16 \pm 1/32$ in. (1.59 ± 0.79 mm) from case for 10 s maximum	$+265^\circ\text{C}$
Unit inserted into PC board min. thickness $1/16$ in. (1.59 mm) with solder contacting lead tips only	$+300^\circ\text{C}$

* For up to 4 outputs per device; add ± 25 mA for each additional output.

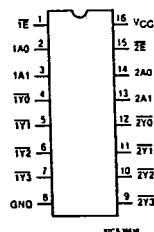
RECOMMENDED OPERATING CONDITIONS:

For maximum reliability, normal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC	LIMITS		UNITS
	MIN.	MAX.	
Supply-Voltage Range, V_{CC} *: (For T_A = Full Package-Temperature Range)			
AC Types	1.5	5.5	V
ACT Types	4.5	5.5	V
DC Input or Output Voltage, V_I , V_O	0	V_{CC}	V
Operating Temperature, T_A	-55	$+125$	$^\circ\text{C}$
Input Rise and Fall Slew Rate, dt/dv			
at 1.5 V to 3 V (AC Types)	0	50	ns/V
at 3.6 V to 5.5 V (AC Types)	0	20	ns/V
at 4.5 V to 5.5 V (ACT Types)	0	10	ns/V

*Unless otherwise specified, all voltages are referenced to ground.

9



TERMINAL ASSIGNMENT

Technical Data

CD54/74AC139

CD54/74ACT139

STATIC ELECTRICAL CHARACTERISTICS: AC Series

T-67-21-55

CHARACTERISTICS		TEST CONDITIONS		V _{CC} (V)	AMBIENT TEMPERATURE (T _A) - °C						UNITS
					+25		-40 to +85		-55 to +125		
		V _I (V)	I _O (mA)		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
High-Level Input Voltage	V _{IH}			1.5	1.2	—	1.2	—	1.2	—	V
				3	2.1	—	2.1	—	2.1	—	
				5.5	3.85	—	3.85	—	3.85	—	
Low-Level Input Voltage	V _{IL}			1.5	—	0.3	—	0.3	—	0.3	V
				3	—	0.9	—	0.9	—	0.9	
				5.5	—	1.65	—	1.65	—	1.65	
High-Level Output Voltage	V _{OH}	V _{IH} or V _{IL} #, *	-0.05	1.5	1.4	—	1.4	—	1.4	—	V
			-0.05	3	2.9	—	2.9	—	2.9	—	
			-0.05	4.5	4.4	—	4.4	—	4.4	—	
			-4	3	2.58	—	2.48	—	2.4	—	
			-24	4.5	3.94	—	3.8	—	3.7	—	
			-75	5.5	—	—	3.85	—	—	—	
			-50	5.5	—	—	—	—	3.85	—	
Low-Level Output Voltage	V _{OL}	V _{IH} or V _{IL} #, *	0.05	1.5	—	0.1	—	0.1	—	0.1	V
			0.05	3	—	0.1	—	0.1	—	0.1	
			0.05	4.5	—	0.1	—	0.1	—	0.1	
			12	3	—	0.36	—	0.44	—	0.5	
			24	4.5	—	0.36	—	0.44	—	0.5	
			75	5.5	—	—	—	1.65	—	—	
			50	5.5	—	—	—	—	—	1.65	
Input Leakage Current	I _I	V _{CC} or GND		5.5	—	±0.1	—	±1	—	±1	μA
Quiescent Supply Current, MSI	I _{CC}	V _{CC} or GND	0	5.5	—	8	—	80	—	160	μA

#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C, 75 ohms at +125°C.

T-67-21-55

CD54/74AC139

CD54/74ACT139

STATIC ELECTRICAL CHARACTERISTICS: ACT Series

CHARACTERISTICS		TEST CONDITIONS		V _{CC} (V)	AMBIENT TEMPERATURE (T _A) - °C						UNITS
					+25		-40 to +85		-55 to +125		
		V _I (V)	I _O (mA)		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
High-Level Input Voltage	V _{IH}			4.5 to 5.5	2	—	2	—	2	—	V
Low-Level Input Voltage	V _{IL}			4.5 to 5.5	—	0.8	—	0.8	—	0.8	V
High-Level Output Voltage	V _{OH}	V _{IH} or V _{IL} #, *	-0.05	4.5	4.4	—	4.4	—	4.4	—	V
			-24	4.5	3.94	—	3.8	—	3.7	—	
			-75	5.5	—	—	3.85	—	—	—	
			-50	5.5	—	—	—	—	3.85	—	
Low-Level Output Voltage	V _{OL}	V _{IH} or V _{IL} #, *	0.05	4.5	—	0.1	—	0.1	—	0.1	V
			24	4.5	—	0.36	—	0.44	—	0.5	
			75	5.5	—	—	—	1.65	—	—	
			50	5.5	—	—	—	—	—	1.65	
Input Leakage Current	I _I	V _{CC} or GND		5.5	—	±0.1	—	±1	—	±1	μA
Quiescent Supply Current, MSI	I _{CC}	V _{CC} or GND	0	5.5	—	8	—	80	—	160	μA
Additional Quiescent Supply Current per Input Pin, TTL Inputs High, 1 Unit Load		ΔI _{CC}	V _{CC} -2.1	4.5 to 5.5		2.4	—	2.8	—	3	mA

#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C, 75 ohms at +125°C.

ACT INPUT LOADING TABLE

INPUT	UNIT LOADS*
A0, A1	1
$\bar{E}$	0.67

*Unit load is ΔI_{CC} limit specified in Static Characteristics Chart, e.g., 2.4 mA max. @ 25°C.

9

Technical Data

CD54/74AC139
CD54/74ACT139

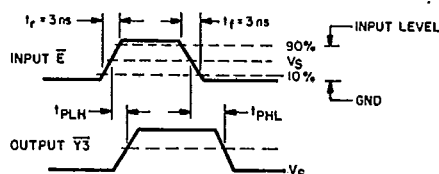
T-67-21-55

SWITCHING CHARACTERISTICS: AC Series; $t_r, t_f = 3 \text{ ns}$, $C_L = 50 \text{ pF}$

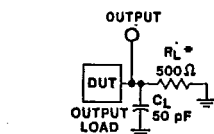
CHARACTERISTICS	SYMBOL	V _{CC} (V)	AMBIENT TEMPERATURE (T _A) - °C				UNITS
			-40 to +85		-55 to +125		
			MIN.	MAX.	MIN.	MAX.	
Propagation Delays: A0, A1 to Outputs	t _{PLH} t _{PHL}	1.5 3.3* 5†	— 3.9 2.8	119 13.4 9.5	— 3.7 2.6	131 14.7 10.5	ns
E to Outputs	t _{PLH} t _{PHL}	1.5 3.1 5	— 3.9 2.8	119 13.4 9.5	— 3.7 2.6	131 14.7 10.5	ns
Power Dissipation Capacitance	C _{PD} §	—	83 Typ.		83 Typ.		pF
Input Capacitance	C _I	—	—	10	—	10	pF

SWITCHING CHARACTERISTICS: ACT Series; $t_r, t_f = 3 \text{ ns}$, $C_L = 50 \text{ pF}$

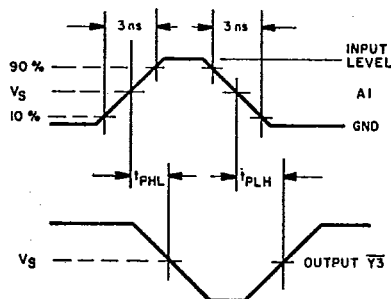
CHARACTERISTICS	SYMBOL	V _{CC} (V)	AMBIENT TEMPERATURE (T _A) - °C				UNITS
			-40 to +85		-55 to +125		
			MIN.	MAX.	MIN.	MAX.	
Propagation Delays: A0, A1 to Outputs	t _{PLH} t _{PHL}	5†	3.1	10.5	2.9	11.5	ns
E̅ to Outputs	t _{PLH} t _{PHL}	5	3.2	10.9	3	12	ns
Power Dissipation Capacitance	C _{PD} §	—	83 Typ.		83 Typ.		pF
Input Capacitance	C _I	—	—	10	—	10	pF

*3.3 V: min. is @ 3.6 V
max. is @ 3 V†5 V: min. is @ 5.5 V
max. is @ 4.5 V§ C_{PD} is used to determine the dynamic power consumption, per decoder/demultiplexer.For AC series: $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$ For ACT series: $P_D = V_{CC}^2 f_i (C_{PD} + C_L) + V_{CC} \Delta I_{CC}$ where f_i = input frequency C_L = output load capacitance V_{CC} = supply voltage.

92CS-42529

*FOR AC SERIES ONLY: WHEN
 $V_{CC} = 1.5 \text{ V}$, $R_L = 1 \text{ k}\Omega$

92CS-42529



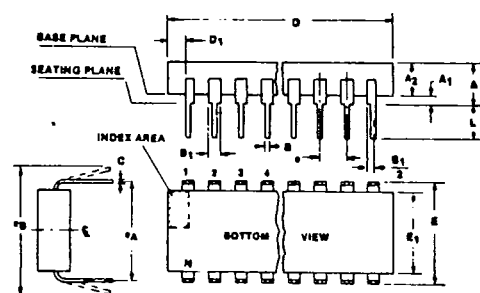
92CS-42530

	CD54/74AC	CD54/74ACT
Input Level	V_{CC}	3 V
Input Switching Voltage, V_S	$0.5 V_{CC}$	1.5 V
Output Switching Voltage, V_S	$0.5 V_{CC}$	$0.5 V_{CC}$

Fig. 1 - Propagation delay times and test circuit.

Dual-In-Line Plastic Packages

T-90-20

(E) Suffix (JEDEC MS-001-AC)
14-Lead Dual-In-Line Plastic Package

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	—	0.210	—	5.33	9
A ₁	0.015	—	0.39	—	9
A ₂	0.115	0.195	2.93	4.95	
B	0.014	0.022	0.356	0.558	
B ₁	0.045	0.070	1.15	1.77	3
C	0.008	0.015	0.204	0.381	
D	0.725	0.795	18.42	20.19	4
D ₁	0.005	—	0.13	—	12
E	0.300	0.325	7.62	8.25	5
E ₁	0.240	0.280	6.10	7.11	6, 7
e	0.100 BSC		2.54 BSC		8
e _A	0.300 BSC		7.62 BSC		9
e _B	—	0.430	—	10.92	10
L	0.115	0.160	2.93	4.06	9
N	14		14		11

92CS-39901

(E) Suffix (JEDEC MS-001-AA)
16-Lead Dual-In-Line Plastic Package

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	—	0.210	—	5.33	9
A ₁	0.015	—	0.39	—	9
A ₂	0.115	0.195	2.93	4.95	
B	0.014	0.022	0.356	0.558	
B ₁	0.045	0.070	1.15	1.77	3
C	0.008	0.015	0.204	0.381	
D	0.745	0.840	18.93	21.33	4
D ₁	0.005	—	0.13	—	12
E	0.300	0.325	7.62	8.25	5
E ₁	0.240	0.280	6.10	7.11	6, 7
e	0.100 BSC		2.54 BSC		8
e _A	0.300 BSC		7.62 BSC		9
e _B	—	0.430	—	10.92	10
L	0.115	0.160	2.93	4.06	9
N	16		16		11

92CS-39900

Notes:

1. Refer to JEDEC Publication No. 95 JEDEC Registered and Standard Outlines for Solid State Products, for rules and general information concerning registered and standard outlines, in Section 2.2.
2. Protrusions (flash) on the base plane surface shall not exceed 0.010 in. (0.25 mm).
3. The dimension shown is for full leads. "Half" leads are optional at lead positions

$$1, N, \frac{N}{2}, \frac{N}{2} + 1.$$
4. Dimension D does not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.010 in. (0.25 mm).
5. E is the dimension to the outside of the leads and is measured with the leads perpendicular to the base plane (zero lead spread).
6. Dimension E₁ does not include mold flash or protrusions.
7. Package body and leads shall be symmetrical around center line shown in end view.
8. Lead spacing e shall be non-cumulative and shall be measured at the lead lip. This measurement shall be made before insertion into gauges, boards or sockets.
9. This is a basic installed dimension. Measurement shall be made with the device installed in the seating plane gauge (JEDEC Outline No. GS-3, seating plane gauge). Leads shall be in true position within 0.010 in. (0.25 mm) diameter for dimension e_A.
10. e_B is the dimension to the outside of the leads and is measured at the lead tips before the device is installed. Negative lead spread is not permitted.
11. N is the maximum number of lead positions.
12. Dimension D₁ at the left end of the package must equal dimension D₁ at the right end of the package within 0.030 in. (0.76 mm).
13. For automatic insertion, any raised irregularity on the top surface (step, mesa, etc.) shall be symmetrical about the lateral and longitudinal package centerlines.

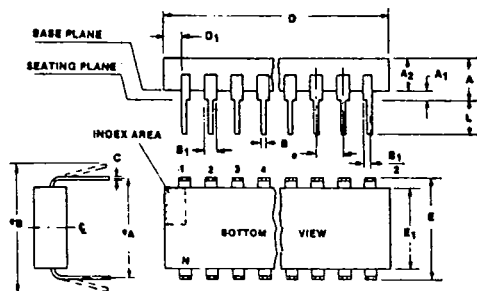
(E) Suffix (JEDEC MS-001-AE)
20-Lead Dual-In-Line Plastic Package

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	—	0.210	—	5.33	9
A ₁	0.015	—	0.39	—	9
A ₂	0.115	0.195	2.93	4.95	
B	0.014	0.022	0.356	0.558	
B ₁	0.045	0.070	1.15	1.77	3
C	0.008	0.015	0.204	0.381	
D	0.925	1.060	23.5	26.9	4
D ₁	0.005	—	0.13	—	12
E	0.300	0.325	7.62	8.25	5
E ₁	0.240	0.280	6.10	7.11	6, 7
e	0.100 BSC		2.54 BSC		8
e _A	0.300 BSC		7.62 BSC		9
e _B	—	0.430	—	10.92	10
L	0.115	0.160	2.93	4.06	9
N	20		20		11

92CS-39997

Dual-In-Line Plastic Packages

T-90-20

(E) Suffix (JEDEC MS-001-AF)
24-Lead Dual-In-Line Plastic Package

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	—	0.210	—	5.33	9
A ₁	0.015	—	0.39	—	9
A ₂	0.115	0.195	2.93	4.95	
B	0.014	0.022	0.356	0.558	
B ₁	0.045	0.070	1.15	1.77	3
C	0.008	0.015	0.204	0.381	
D	1.125	1.275	28.6	32.3	4
D ₁	0.005	—	0.13	—	12
E	0.300	0.325	7.62	8.25	5
E ₁	0.240	0.280	6.10	7.11	6, 7
e	0.100 BSC		2.54 BSC		8
e _A	0.300 BSC		7.62 BSC		9
e _B	—	0.430	—	10.92	10
L	0.115	0.160	2.93	4.06	9
N	24		24		11

92CS-39943

Notes:

1. Refer to JEDEC Publication No. 95 JEDEC Registered and Standard Outlines for Solid State Products, for rules and general information concerning registered and standard outlines, in Section 2.2.
2. Protrusions (flash) on the base plane surface shall not exceed 0.010 in. (0.25 mm).
3. The dimension shown is for full leads. "Half" leads are optional at lead positions

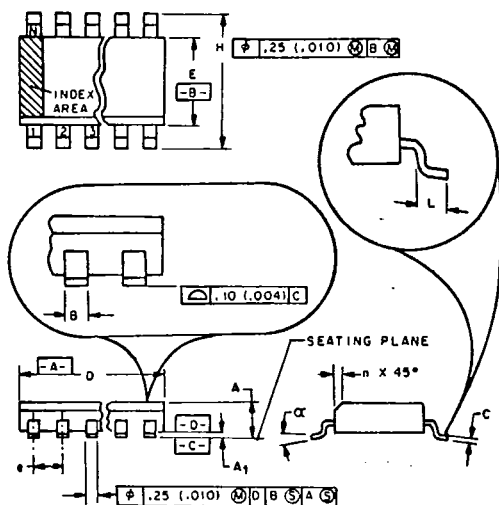
$$1, N, \frac{N}{2}, \frac{N}{2} + 1.$$
4. Dimension D does not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.010 in. (0.25 mm).
5. E is the dimension to the outside of the leads and is measured with the leads perpendicular to the base plane (zero lead spread).
6. Dimension E₁ does not include mold flash or protrusions.
7. Package body and leads shall be symmetrical around

center line shown in end view.

8. Lead spacing e shall be non-cumulative and shall be measured at the lead tip. This measurement shall be made before insertion into gauges, boards or sockets.
9. This is a basic installed dimension. Measurement shall be made with the device installed in the seating plane gauge (JEDEC Outline No. GS-3, seating plane gauge). Leads shall be in true position within 0.010 in. (0.25 mm) diameter for dimension e_A.
10. e_B is the dimension to the outside of the leads and is measured at the lead tips before the device is installed. Negative lead spread is not permitted.
11. N is the maximum number of lead positions.
12. Dimension D₁ at the left end of the package must equal dimension D₁ at the right end of the package within 0.030 in. (0.76 mm).
13. For automatic insertion, any raised irregularity on the top surface (step, mesa, etc.) shall be symmetrical about the lateral and longitudinal package centerlines.

13

Dual-In-Line Small-Outline Plastic Packages



NOTES:

1. Refer to applicable symbol list.
2. Dimensioning and tolerancing per ANSI Y14.5M-1982.
3. "D" is a reference datum.
4. "A" and "B" are reference datums and do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15 mm (0.006 in.).
5. The chamfer on the body is optional. If it is not present, a visual index feature must be located within the cross-hatched area.
6. "L" is the length of terminal for soldering to a substrate.
7. "N" is the number of terminal positions.
8. Terminal numbers are shown for reference only.
9. Controlling dimensions: MILLIMETERS.

T-90-20

M Suffix (JEDEC MS-012AB)

14-Lead Dual-In-Line Small-Outline (SO) Package

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.0532	0.0688	1.35	1.75	
A ₁	0.0040	0.0098	0.10	0.25	
B	0.0138	0.020	0.35	0.508	
C	0.0075	0.0098	0.19	0.25	
D	0.3367	0.3444	8.55	8.75	4
E	0.1497	0.1574	3.80	4.00	4
e	0.050 BSC		1.27 BSC		
H	0.2284	0.2440	5.80	6.20	
h	0.0099	0.0196	0.25	0.50	5
L	0.016	0.050	0.40	1.27	6
N	14		14		7
α	0°	8°	0°	8°	

Notes: 1, 2, 3, 8, 9

92CS-38924R2

M Suffix (JEDEC MS-012AC)

16-Lead Dual-In-Line Small-Outline (SO) Package

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.0532	0.0688	1.35	1.75	
A ₁	0.0040	0.0098	0.10	0.25	
B	0.0138	0.020	0.35	0.508	
C	0.0075	0.0098	0.19	0.25	
D	0.3859	0.3937	9.80	10.00	4
E	0.1497	0.1574	3.80	4.00	4
e	0.050 BSC		1.27 BSC		
H	0.2284	0.2440	5.80	6.20	
h	0.0099	0.0196	0.25	0.50	5
L	0.016	0.050	0.40	1.27	6
N	16		16		7
α	0°	8°	0°	8°	

Notes: 1, 2, 3, 8, 9

92CS-38925R2

M Suffix (JEDEC MS-013AC)

20-Lead Dual-In-Line Small-Outline (SO) Package

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.0926	0.1043	2.35	2.65	
A ₁	0.0040	0.0118	0.10	0.30	
B	0.0138	0.020	0.35	0.508	
C	0.0091	0.0125	0.23	0.32	
D	0.4861	0.5118	12.60	13.00	4
E	0.2914	0.2992	7.40	7.60	4
e	0.050 BSC		1.27 BSC		
H	0.394	0.419	10.00	10.65	
h	0.010	0.029	0.25	0.75	5
L	0.016	0.050	0.40	1.27	6
N	20		20		7
α	0°	8°	0°	8°	

Notes: 1, 2, 3, 8, 9

92CS-38926R2

M Suffix (JEDEC MS-013AD)

24-Lead Dual-In-Line Small-Outline (SO) Package

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.0926	0.1043	2.35	2.65	
A ₁	0.0040	0.0118	0.10	0.30	
B	0.0138	0.020	0.35	0.508	
C	0.0091	0.0125	0.23	0.32	
D	0.5985	0.6141	15.20	15.60	4
E	0.2914	0.2992	7.40	7.60	4
e	0.050 BSC		1.27 BSC		
H	0.394	0.419	10.00	10.65	
h	0.010	0.029	0.25	0.75	5
L	0.016	0.050	0.40	1.27	6
N	24		24		7
α	0°	8°	0°	8°	

Notes: 1, 2, 3, 8, 9

92CS-39037R2