

DM74LS174/DM74LS175 Hex/Quad D Flip-Flops with Clear

General Description

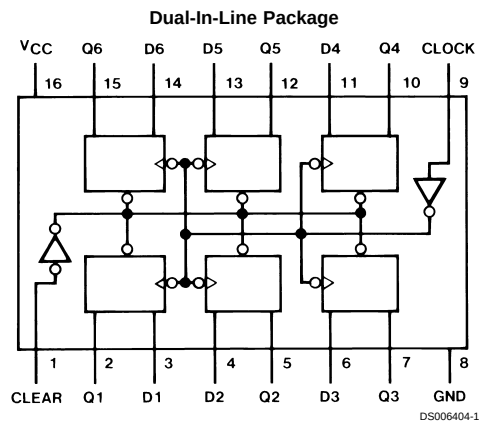
These positive-edge-triggered flip-flops utilize TTL circuitry to implement D-type flip-flop logic. All have a direct clear input, and the quad (175) versions feature complementary outputs from each flip-flop.

Information at the D inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going pulse. When the clock input is at either the high or low level, the D input signal has no effect at the output.

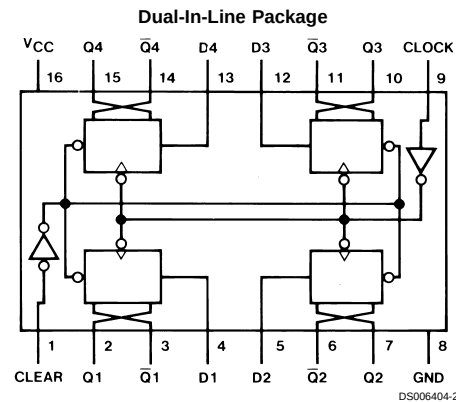
Features

- LS174 contains six flip-flops with single-rail outputs
- LS175 contains four flip-flops with double-rail outputs
- Buffered clock and direct clear inputs
- Individual data input to each flip-flop
- Applications include:
 - Buffer/storage registers
 - Shift registers
 - Pattern generators
- Typical clock frequency 40 MHz
- Typical power dissipation per flip-flop 14 mW
- Alternate Military/Aerospace device (54LS174, 54LS175) is available. Contact a Fairchild Semiconductor Sales Office/Distributor for specifications.

Connection Diagrams



Order Number 54LS174DMQB, 54LS174FMQB,
54LS174LMQB, DM54LS174J,
DM54LS174W, DM74LS174M or DM74LS174N
See Package Number E20A, J16A,
M16A, N16E or W16A



Order Number 54LS175DMQB, 54LS175FMQB,
54LS175LMQB, DM54LS175J,
DM54LS175W, DM74LS175M or DM74LS175N
See Package Number E20A, J16A,
M16A, N16E or W16A

Function Table

(Each Flip-Flop)

Inputs			Outputs	
Clear	Clock	D	Q	$\overline{Q}$ †
L	X	X	L	H
H	↑	H	H	L
H	↑	L	L	H
H	L	X	Q ₀	$\overline{Q}_0$

H = High Level (steady state)

L = Low Level (steady state)

X = Don't Care

↑ = Transition from low to high level

Q₀ = The level of Q before the indicated steady-state input conditions were established.

† = LS175 only

Absolute Maximum Ratings (Note 1)

Supply Voltage	7V	DM54LS and 54LS	–55°C to +125°C
Input Voltage	7V	DM74LS	0°C to +70°C
Operating Free Air Temperature Range		Storage Temperature Range	–65°C to +150°C

Recommended Operating Conditions

Symbol	Parameter	DM54LS174			DM74LS174			Units
		Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			2			V
V_{IL}	Low Level Input Voltage			0.7			0.8	V
I_{OH}	High Level Output Current			–0.4			–0.4	mA
I_{OL}	Low Level Output Current			4			8	mA
f_{CLK}	Clock Frequency (Note 2)	0		30	0		30	MHz
f_{CLK}	Clock Frequency (Note 3)	0		25	0		25	MHz
t_W	Pulse Width (Note 7)	Clock	20		20			ns
		Clear	20		20			
t_{SU}	Data Setup Time (Note 7)	20			20			ns
t_H	Data Hold Time (Note 7)	0			0			ns
t_{REL}	Clear Release Time (Note 7)	25			25			ns
T_A	Free Air Operating Temperature	–55		125	0		70	°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

'LS174 Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 4)	Max	Units
V_I	Input Clamp Voltage	$V_{CC} = \text{Min}$, $I_I = -18 \text{ mA}$			–1.5	V
V_{OH}	High Level Output Voltage	$V_{CC} = \text{Min}$, $I_{OH} = \text{Max}$	DM54	2.5	3.4	V
		$V_{IL} = \text{Max}$, $V_{IH} = \text{Min}$	DM74	2.7	3.4	
V_{OL}	Low Level Output Voltage	$V_{CC} = \text{Min}$, $I_{OL} = \text{Max}$	DM54		0.25	V
		$V_{IL} = \text{Max}$, $V_{IH} = \text{Min}$	DM74		0.35	
		$I_{OL} = 4 \text{ mA}$, $V_{CC} = \text{Min}$	DM74		0.25	
I_I	Input Current@Max Input Voltage	$V_{CC} = \text{Max}$, $V_I = 7V$			0.1	mA
I_{IH}	High Level Input Current	$V_{CC} = \text{Max}$, $V_I = 2.7V$			20	μA
I_{IL}	Low Level Input Current	$V_{CC} = \text{Max}$ $V_I = 0.4V$	Clock		–0.4	mA
			Clear		–0.4	
			Data		–0.36	
I_{OS}	Short Circuit Output Current	$V_{CC} = \text{Max}$ (Note 5)	DM54	–20	–100	mA
			DM74	–20	–100	
I_{CC}	Supply Current	$V_{CC} = \text{Max}$ (Note 6)		16	26	mA

Note 2: $C_L = 15 \text{ pF}$, $R_L = 2 \text{ k}\Omega$, $T_A = 25^\circ\text{C}$ and $V_{CC} = 5V$.

Note 3: $C_L = 50 \text{ pF}$, $R_L = 2 \text{ k}\Omega$, $T_A = 25^\circ\text{C}$ and $V_{CC} = 5V$.

Note 4: All typicals are at $V_{CC} = 5V$, $T_A = 25^\circ\text{C}$.

Note 5: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 6: With all outputs open and 4.5V applied to all data and clear inputs, I_{CC} is measured after a momentary ground, then 4.5V applied to the clock.

Note 7: $T_A = 25^\circ\text{C}$ and $V_{CC} = 5V$.

'LS174 Switching Characteristics

at $V_{CC} = 5V$ and $T_A = 25^\circ C$ (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	From (Input) To (Output)	R _L = 2 kΩ				Units
			C _L = 15 pF		C _L = 50 pF		
			Min	Max	Min	Max	
f _{MAX}	Maximum Clock Frequency		30		25		MHz
t _{PLH}	Propagation Delay Time Low to High Level Output	Clock to Output		30		32	ns
t _{PHL}	Propagation Delay Time High to Low Level Output	Clock to Output		30		36	ns
t _{PHL}	Propagation Delay Time High to Low Level Output	Clear to Output		35		42	ns

Recommended Operating Conditions

Symbol	Parameter	DM54LS175			DM74LS175			Units
		Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			2			V
V_{IL}	Low Level Input Voltage			0.7			0.8	V
I_{OH}	High Level Output Current			-0.4			-0.4	mA
I_{OL}	Low Level Output Current			4			8	mA
f_{CLK}	Clock Frequency (Note 8)	0		30	0		30	MHz
f_{CLK}	Clock Frequency (Note 9)	0		25	0		25	MHz
t_W	Pulse Width (Note 10)	Clock	20		20			ns
		Clear	20		20			
t_{SU}	Data Setup Time (Note 10)	20			20			ns
t_H	Data Hold Time (Note 10)	0			0			ns
t_{REL}	Clear Release Time (Note 10)	25			25			ns
T_A	Free Air Operating Temperature	-55		125	0		70	$^\circ C$

Note 8: $C_L = 15\text{ pF}$, $R_L = 2\text{ k}\Omega$, $T_A = 25^\circ C$ and $V_{CC} = 5V$.

Note 9: $C_L = 50\text{ pF}$, $R_L = 2\text{ k}\Omega$, $T_A = 25^\circ C$ and $V_{CC} = 5V$.

Note 10: $T_A = 25^\circ C$ and $V_{CC} = 5V$.

'LS175 Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 11)	Max	Units
V_I	Input Clamp Voltage	$V_{CC} = \text{Min}, I_I = -18 \text{ mA}$			-1.5	V
V_{OH}	High Level Output Voltage	$V_{CC} = \text{Min}, I_{OH} = \text{Max}$ $V_{IL} = \text{Max}, V_{IH} = \text{Min}$	DM54 2.5 DM74 2.7	3.4 3.4		V
V_{OL}	Low Level Output Voltage	$V_{CC} = \text{Min}, I_{OL} = \text{Max}$ $V_{IL} = \text{Max}, V_{IH} = \text{Min}$ $I_{OL} = 4 \text{ mA}, V_{CC} = \text{Min}$	DM54 DM74 DM74	0.25 0.35 0.25	0.4 0.5 0.4	V
I_I	Input Current@Max Input Voltage	$V_{CC} = \text{Max}, V_I = 7\text{V}$			0.1	mA
I_{IH}	High Level Input Current	$V_{CC} = \text{Max}, V_I = 2.7\text{V}$			20	μA
I_{IL}	Low Level Input Current	$V_{CC} = \text{Max}$ $V_I = 0.4\text{V}$	Clock Clear Data		-0.4 -0.4 -0.36	mA
I_{OS}	Short Circuit Output Current	$V_{CC} = \text{Max}$ (Note 12)	DM54 DM74	-20 -20	-100 -100	mA
I_{CC}	Supply Current	$V_{CC} = \text{Max}$ (Note 13)		11	18	mA

'LS175 Switching Characteristics

at $V_{CC} = 5\text{V}$ and $T_A = 25^\circ\text{C}$ (See Section 1 for Test Waveforms and Output Load)

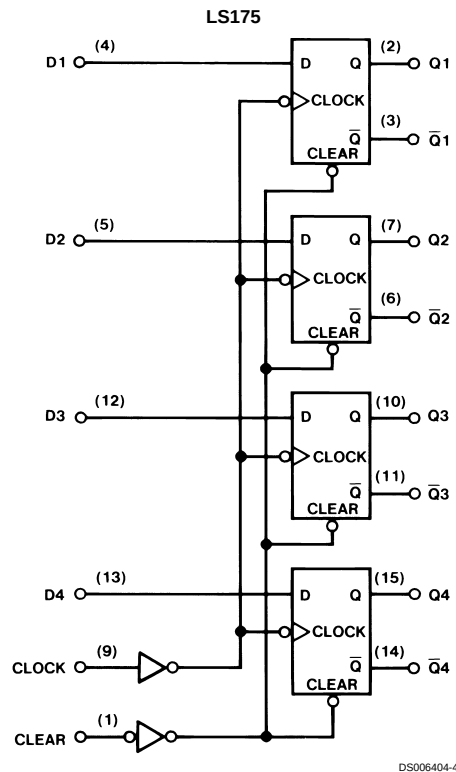
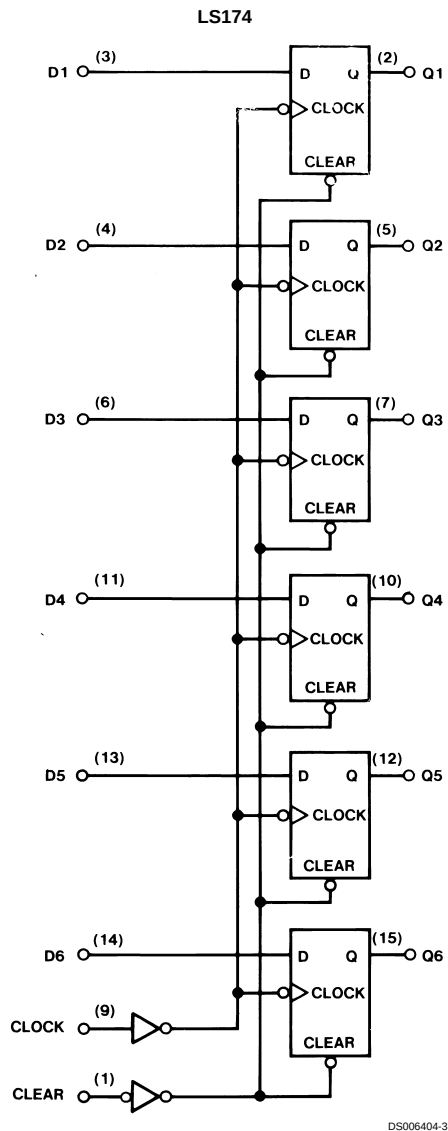
Symbol	Parameter	From (Input) To (Output)	R _L = 2 kΩ				Units
			C _L = 15 pF		C _L = 50 pF		
			Min	Max	Min	Max	
f _{MAX}	Maximum Clock Frequency		30		25		MHz
t _{PLH}	Propagation Delay Time Low to High Level Output	Clock to Q or $\overline{Q}$		30		32	ns
t _{PHL}	Propagation Delay Time High to Low Level Output	Clock to Q or $\overline{Q}$		30		36	ns
t _{PLH}	Propagation Delay Time Low to High Level Output	Clear to $\overline{Q}$		25		29	ns
t _{PHL}	Propagation Delay Time High to Low Level Output	Clear to Q		35		42	ns

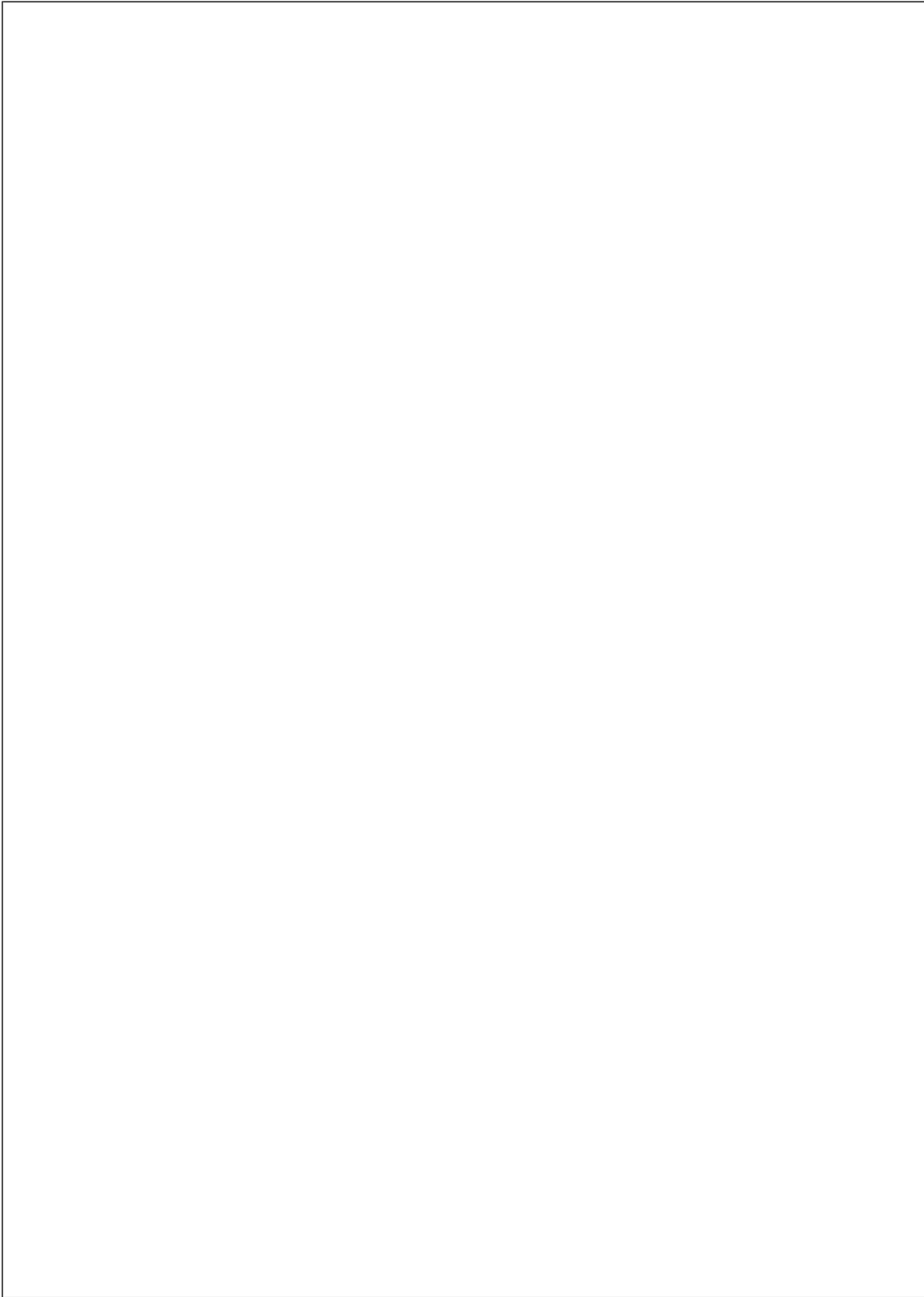
Note 11: All typicals are at $V_{CC} = 5\text{V}$, $T_A = 25^\circ\text{C}$.

Note 12: Not more than one output should be shorted at a time, and the duration should not exceed one second.

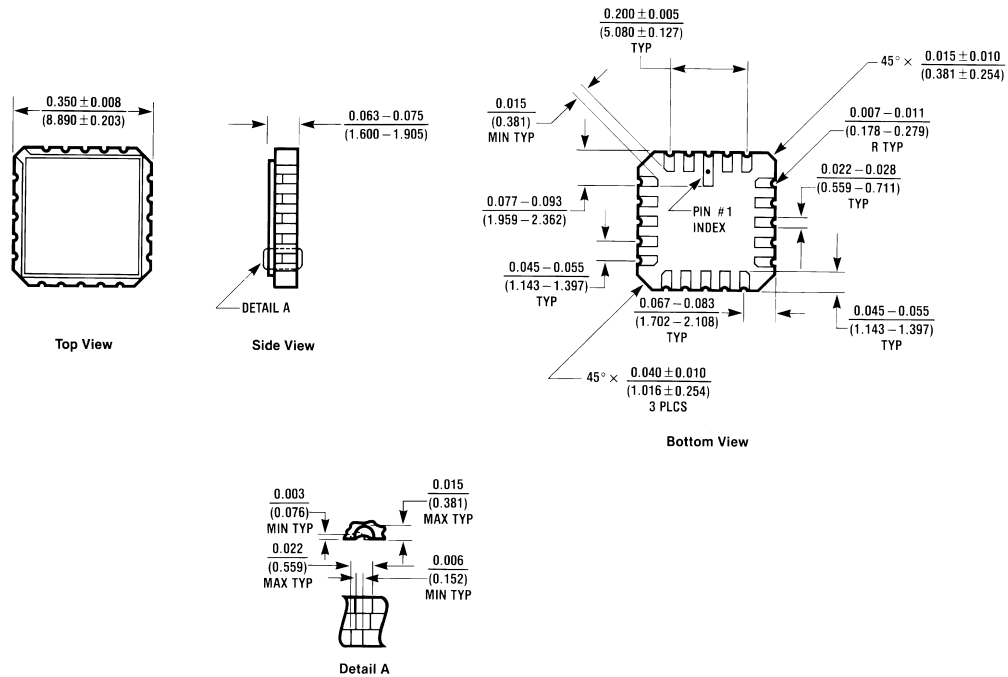
Note 13: With all outputs open and 4.5V applied to all data and clear inputs, I_{CC} is measured after a momentary ground, then 4.5V applied to the clock input.

Logic Diagrams



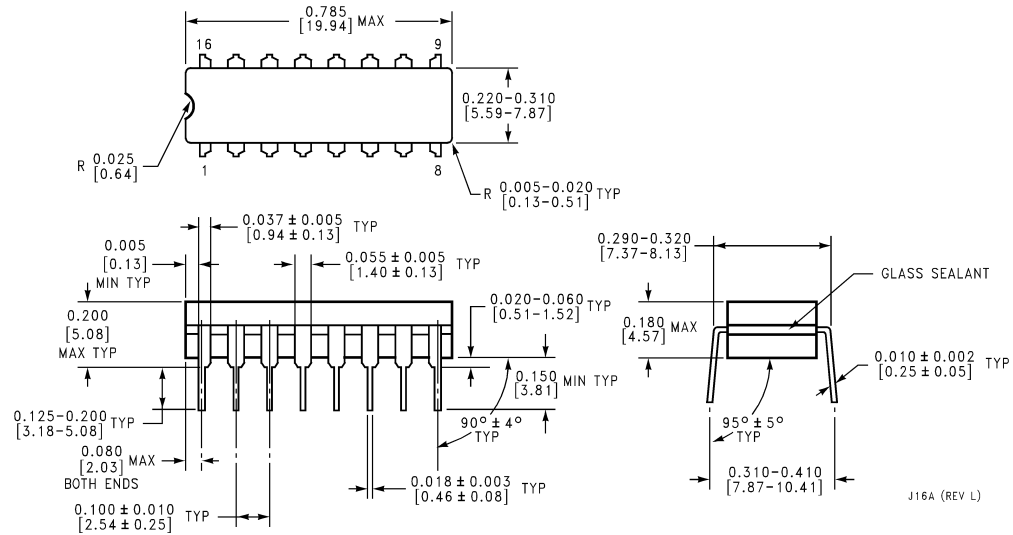


Physical Dimensions inches (millimeters) unless otherwise noted



E20A (REV D)

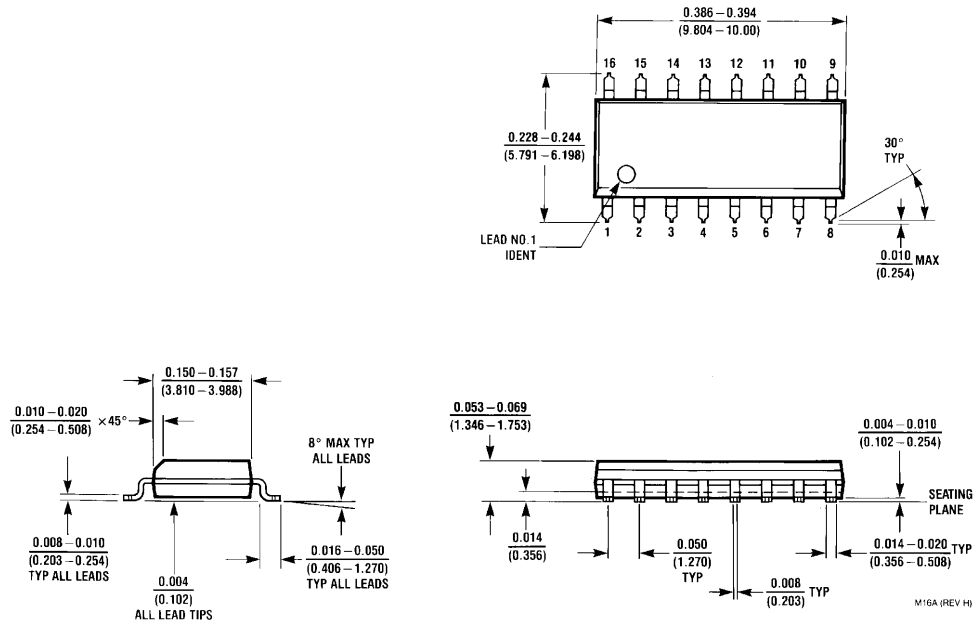
Ceramic Leadless Chip Carrier (E) Order Number 54LS174LMQB or 54LS175LMQB Package Number E20A



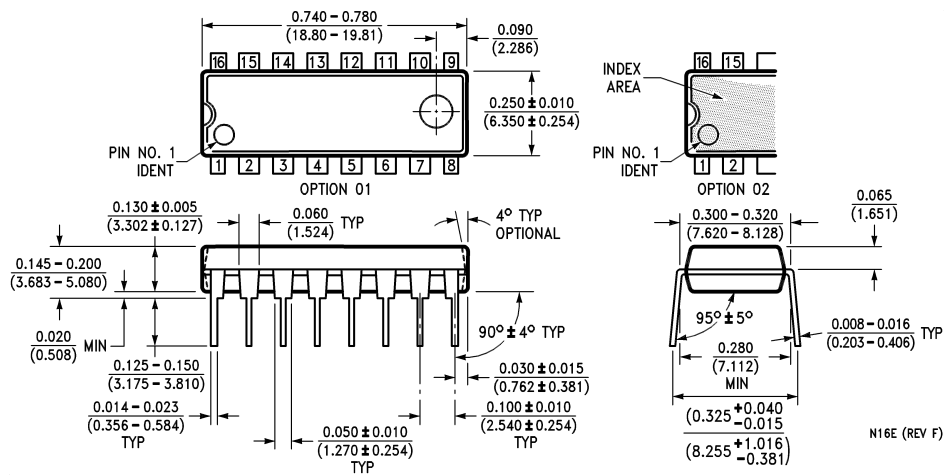
J16A (REV L)

16-Lead Ceramic Dual-In-Line Package (J) Order Number DM54LS174DMQB, 54LS175DMQB, DM54LS174J or DM54LS175J Package Number J16A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

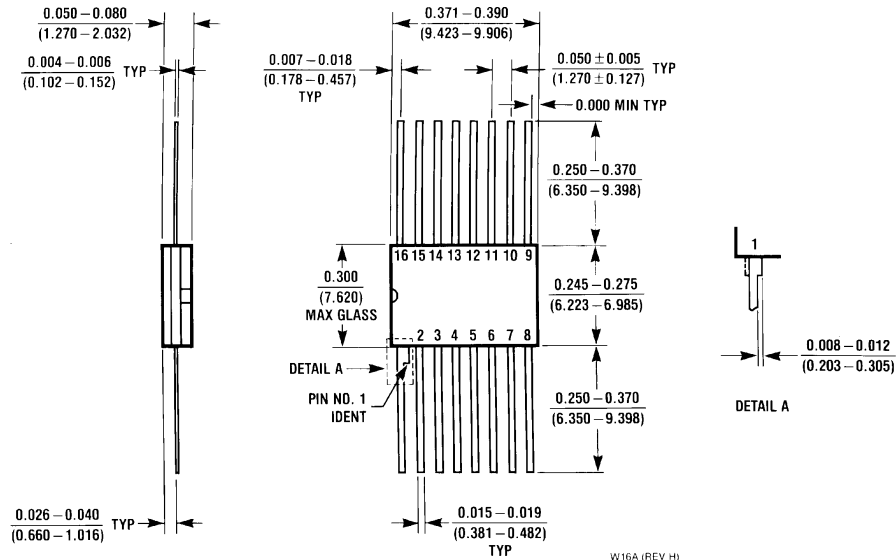


16-Lead Small Outline Molded Package (M)
Order Number DM74LS174M or DM74LS175M
Package Number M16A



16-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS174N or DM74LS175N
Package Number N16E

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



16-Lead Ceramic Flat Package (W)
Order Number 54LS174FMQB, 54LS175FMQB, DM54LS174W or DM54LS175W
Package Number W16A

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Fairchild Semiconductor Corporation Americas
 Customer Response Center
 Tel: 1-888-522-5372

Fairchild Semiconductor Europe
 Fax: +49 (0) 1 80-530 85 86
 Email: europe.support@nsc.com
 Deutsch Tel: +49 (0) 8 141-35-0
 English Tel: +44 (0) 1 793-85-68-56
 Italy Tel: +39 (0) 2 57 5631

Fairchild Semiconductor Hong Kong Ltd.
 13th Floor, Straight Block,
 Ocean Centre, 5 Canton Rd.
 Tsimshatsui, Kowloon
 Hong Kong
 Tel: +852 2737-7200
 Fax: +852 2314-0061

National Semiconductor Japan Ltd.
 Tel: 81-3-5620-6175
 Fax: 81-3-5620-6179

www.fairchildsemi.com