74AC74, 74ACT74

Dual D-Type Positive Edge-Triggered Flip-Flop

The AC/ACT74 is a dual D-type flip-flop with Asynchronous Clear and Set inputs and complementary (Q, Q) outputs. Information at the input is transferred to the outputs on the positive edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. After the Clock Pulse input threshold voltage has been passed, the Data input is locked out and information present will not be transferred to the outputs until the next rising edge of the Clock Pulse input.

Rochester Electronics Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All re-creations are done with the approval of the Original Component Manufacturer (OCM).

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

Quality Overview

• ISO-9001
• AS9120 certification
• Qualified Manufacturers List (QML) MIL-PRF-35835
  • Class Q Military
  • Class V Space Level
• Qualified Suppliers List of Distributors (QSLD)
  • Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OCM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

FOR REFERENCE ONLY

FAIRCHILD

SEMICONDUCTOR®

January 2008

74AC74, 74ACT74
Dual D-Type Positive Edge-Triggered Flip-Flop

Features

■ I_{CC} reduced by 50%
■ Output source/sink 24mA
■ ACT74 has TTL-compatible inputs

General Description

The AC/ACT74 is a dual D-type flip-flop with Asynchronous Clear and Set inputs and complementary (Q, $\overline{Q}$) outputs. Information at the input is transferred to the outputs on the positive edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. After the Clock Pulse input threshold voltage has been passed, the Data input is locked out and information present will not be transferred to the outputs until the next rising edge of the Clock Pulse input.

Asynchronous Inputs:

■ LOW input to $\overline{S}_D$ (Set) sets Q to HIGH level
■ LOW input to $\overline{C}_D$ (Clear) sets Q to LOW level
■ Clear and Set are independent of clock
■ Simultaneous LOW on $\overline{C}_D$ and $\overline{S}_D$ makes both Q and $\overline{Q}$ HIGH

Ordering Information

| Order Number	Package Number	Package Description
74AC74SC	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74AC74SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74AC74MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74AC74PC	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
74ACT74SC	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74ACT74SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74ACT74MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74ACT74PC	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.

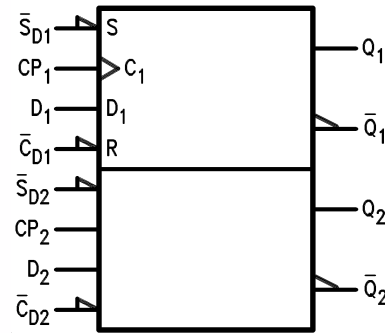All packages are lead free per JEDEC: J-STD-020B standard.

Connection Diagram
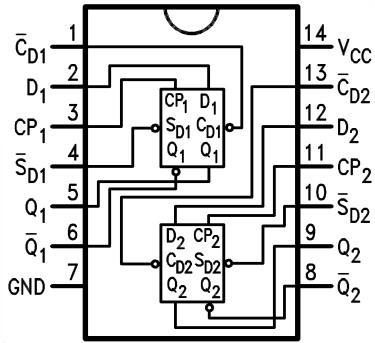
Logic Symbols
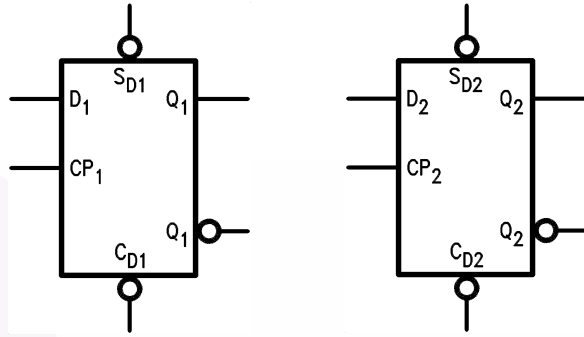
IEEE/IEC

Pin Descriptions

Pin Names	Description
D_1, D_2	Data Inputs
CP_1, CP_2	Clock Pulse Inputs
$\overline{C}_{D1}$, $\overline{C}_{D2}$	Direct Clear Inputs
$\overline{S}_{D1}$, $\overline{S}_{D2}$	Direct Set Inputs
Q_1, $\overline{Q}_1$, Q_2, $\overline{Q}_2$	Outputs

Truth Table

(Each Half)

Inputs				Outputs	
$\overline{S}_D$	$\overline{C}_D$	CP	D	Q	Q
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H	H
H	H	$\_\!\!\_\!/$	H	H	L
H	H	$\_\!\!\_\!/$	L	L	H
H	H	L	X	Q_0	$\overline{Q}_0$

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

$\_\!\!\_\!/$ = LOW-to-HIGH Clock Transition

Q_0 ($\overline{Q}_0$) = Previous Q ($\overline{Q}$) before LOW-to-HIGH Transition of Clock

Logic Diagram

$\overline{S}_D$

D

CP

$\overline{C}_D$

Q

$\overline{Q}$
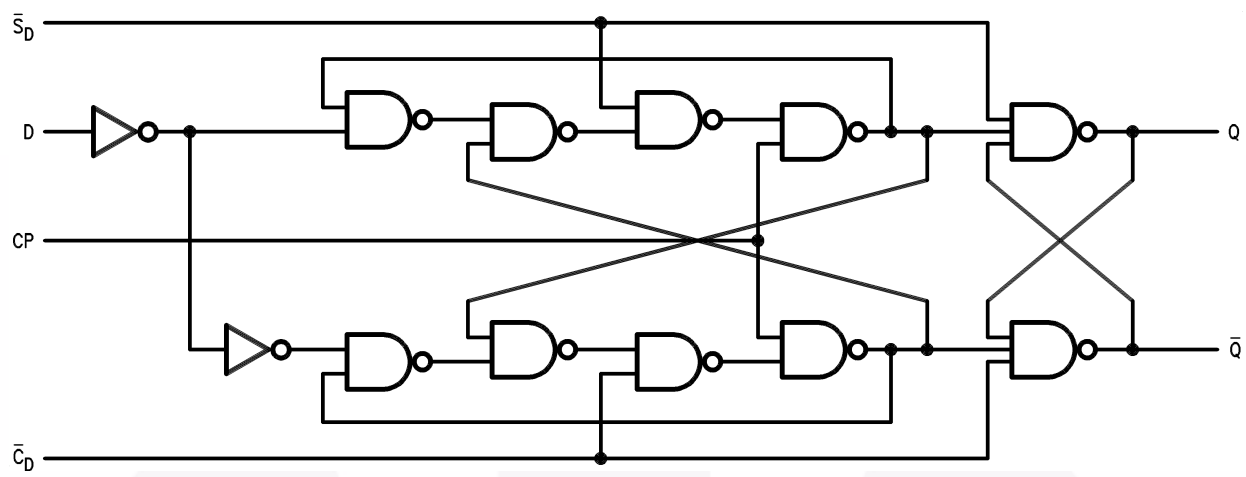
Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
V_{CC}	Supply Voltage	–0.5V to +7.0V
I_{IK}	DC Input Diode Current	
	$V_I = -0.5V$	–20mA
	$V_I = V_{CC} + 0.5$	+20mA
V_I	DC Input Voltage	–0.5V to V_{CC} + 0.5V
I_{OK}	DC Output Diode Current	
	$V_O = -0.5V$	–20mA
	$V_O = V_{CC} + 0.5V$	+20mA
V_O	DC Output Voltage	–0.5V to V_{CC} + 0.5V
I_O	DC Output Source or Sink Current	±50mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current per Output Pin	±50mA
T_{STG}	Storage Temperature	–65°C to +150°C
T_J	Junction Temperature	140°C

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating
V_{CC}	Supply Voltage	
	AC	2.0V to 6.0V
	ACT	4.5V to 5.5V
V_I	Input Voltage	0V to V_{CC}
V_O	Output Voltage	0V to V_{CC}
T_A	Operating Temperature	–40°C to +85°C
$\Delta V / \Delta t$	Minimum Input Edge Rate, AC Devices: V_{IN} from 30% to 70% of V_{CC}, V_{CC} @ 3.3V, 4.5V, 5.5V	125mV/ns
$\Delta V / \Delta t$	Minimum Input Edge Rate, ACT Devices: V_{IN} from 0.8V to 2.0V, V_{CC} @ 4.5V, 5.5V	125mV/ns

DC Electrical Characteristics for AC

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C Typ.	T_A = +25°C Guaranteed Limits	T_A = −40°C to +85°C Guaranteed Limits	Units
V_{IH}	Minimum HIGH Level Input Voltage	3.0	V_{OUT} = 0.1V or V_{CC} − 0.1V	1.5	2.1	2.1	V
		4.5		2.25	3.15	3.15	
		5.5		2.75	3.85	3.85	
V_{IL}	Maximum LOW Level Input Voltage	3.0	V_{OUT} = 0.1V or V_{CC} − 0.1V	1.5	0.9	0.9	V
		4.5		2.25	1.35	1.35	
		5.5		2.75	1.65	1.65	
V_{OH}	Minimum HIGH Level Output Voltage	3.0	I_{OUT} = −50µA	2.99	2.9	2.9	V
		4.5		4.49	4.4	4.4	
		5.5		5.49	5.4	5.4	
		3.0	V_{IN} = V_{IL} or V_{IH}, I_{OH} = −12mA		2.56	2.46	
		4.5	V_{IN} = V_{IL} or V_{IH}, I_{OH} = −24mA		3.86	3.76	
		5.5	V_{IN} = V_{IL} or V_{IH}, I_{OH} = −24mA[1]		4.86	4.76	
V_{OL}	Maximum LOW Level Output Voltage	3.0	I_{OUT} = 50µA	0.002	0.1	0.1	V
		4.5		0.001	0.1	0.1	
		5.5		0.001	0.1	0.1	
		3.0	V_{IN} = V_{IL} or V_{IH}, I_{OL} = 12mA		0.36	0.44	
		4.5	V_{IN} = V_{IL} or V_{IH}, I_{OL} = 24mA		0.36	0.44	
		5.5	V_{IN} = V_{IL} or V_{IH}, I_{OL} = 24mA[1]		0.36	0.44	
I_{IN}[3]	Maximum Input Leakage Current	5.5	V_I = V_{CC}, GND		±0.1	±1.0	µA
I_{OLD}	Minimum Dynamic Output Current[2]	5.5	V_{OLD} = 1.65V Max.			75	mA
I_{OHD}		5.5	V_{OHD} = 3.85V Min.			−75	mA
I_{CC}[3]	Maximum Quiescent Supply Current	5.5	V_{IN} = V_{CC} or GND		2.0	20.0	µA

Notes:

1. All outputs loaded; thresholds on input associated with output under test.

2. Maximum test duration 2.0ms, one output loaded at a time.

3. I_{IN} and I_{CC} @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V_{CC}.

DC Electrical Characteristics for ACT

Symbol	Parameter	V_CC (V)	Conditions	T_A = +25°C Typ.	T_A = +25°C Guaranteed Limits	T_A = –40°C to +85°C Guaranteed Limits	Units
V_{IH}	Minimum HIGH Level Input Voltage	4.5	$V_{OUT} = 0.1V$ or $V_{CC} – 0.1V$	1.5	2.0	2.0	V
		5.5		1.5	2.0	2.0	
V_{IL}	Maximum LOW Level Input Voltage	4.5	$V_{OUT} = 0.1V$ or $V_{CC} – 0.1V$	1.5	0.8	0.8	V
		5.5		1.5	0.8	0.8	
V_{OH}	Minimum HIGH Level Output Voltage	4.5	$I_{OUT} = –50\mu A$	4.49	4.4	4.4	V
		5.5		5.49	5.4	5.4	
		4.5	$V_{IN} = V_{IL}$ or V_{IH}, $I_{OH} = –24mA$		3.86	3.76	
		5.5	$V_{IN} = V_{IL}$ or V_{IH}, $I_{OH} = –24mA^{(4)}$		4.86	4.76	
V_{OL}	Maximum LOW Level Output Voltage	4.5	$I_{OUT} = 50\mu A$	0.001	0.1	0.1	V
		5.5		0.001	0.1	0.1	
		4.5	$V_{IN} = V_{IL}$ or V_{IH}, $I_{OL} = 24mA$		0.36	0.44	
		5.5	$V_{IN} = V_{IL}$ or V_{IH}, $I_{OL} = 24mA^{(4)}$		0.36	0.44	
I_{IN}	Maximum Input Leakage Current	5.5	$V_I = V_{CC}$, GND		±0.1	±1.0	μA
I_{CCT}	Maximum I_{CC}/Input	5.5	$V_I = V_{CC} – 2.1V$	0.6		1.5	mA
I_{OLD}	Minimum Dynamic Output Current[5]	5.5	$V_{OLD} = 1.65V$ Max.			75	mA
I_{OHD}		5.5	$V_{OHD} = 3.85V$ Min.			–75	mA
I_{CC}	Maximum Quiescent Supply Current	5.5	$V_{IN} = V_{CC}$ or GND		2.0	20.0	μA

Notes:

4. All outputs loaded; thresholds on input associated with output under test.

AC Electrical Characteristics for AC

Symbol	Parameter	V_{CC} (V)[6]	T_A = +25°C, C_L = 50pF			T_A = −40°C to +85°C, C_L = 50pF		Units
			Min.	Typ.	Max.	Min.	Max.	
f_{MAX}	Maximum Clock Frequency	3.3	100	125		95		MHz
		5.0	140	160		125		
t_{PLH}	Propagation Delay, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q_n or $\overline{Q}_n$	3.3	3.5	8.0	12.0	2.5	13.0	ns
		5.0	2.5	6.0	9.0	2.0	10.0	
t_{PHL}	Propagation Delay, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q_n or $\overline{Q}_n$	3.3	4.0	10.5	12.0	3.5	13.5	ns
		5.0	3.0	8.0	9.5	2.5	10.5	
t_{PLH}	Propagation Delay, CP_n to Q_n or $\overline{Q}_n$	3.3	4.5	8.0	13.5	4.0	16.0	ns
		5.0	3.5	6.0	10.0	3.0	10.5	
t_{PHL}	Propagation Delay, CP_n to Q_n or $\overline{Q}_n$	3.3	3.5	8.0	14.0	3.5	14.5	ns
		5.0	2.5	6.0	10.0	2.5	10.5	

Note:
5. Voltage range 3.3 is 3.3V ± 0.3V. Voltage range 5.0 is 5.0V ± 0.5V.

AC Operating Requirements for AC

Symbol	Parameter	V_{CC} (V)[7]	T_A = +25°C, C_L = 50pF	T_A = −40°C to +85°C, C_L = 50 pF		Units
			Typ.	Guaranteed Minimum		
t_S	Set-up Time, HIGH or LOW, D_n to CP_n	3.3	1.5	4.0	4.5	ns
		5.0	1.0	3.0	3.0	
t_H	Hold Time, HIGH or LOW, D_n to CP_n	3.3	−2.0	0.5	0.5	ns
		5.0	−1.5	0.5	0.5	
t_W	CP_n or $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ Pulse Width	3.3	3.0	5.5	7.0	ns
		5.0	2.5	4.5	5.0	
t_{rec}	Recovery Time, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to CP	3.3	−2.5	0	0	ns
		5.0	−2.0	0	0	

Note:
6. Voltage range 3.3 is 3.3V ± 0.3V. Voltage range 5.0 is 5.0V ± 0.5V.

AC Electrical Characteristics for ACT

Symbol	Parameter	V_{CC} (V)[8]	T_A = +25°C, C_L = 50pF			T_A = –40°C to +85°C, C_L = 50pF		Units
			Min.	Typ.	Max.	Min.	Max.	
f_{MAX}	Maximum Clock Frequency	5.0	145	210		125		MHz
t_{PLH}	Propagation Delay, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q_n or $\overline{Q}_n$	5.0	3.0	5.5	9.5	2.5	10.5	ns
t_{PHL}	Propagation Delay, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q_n or $\overline{Q}_n$	5.0	3.0	6.0	10.0	3.0	11.5	ns
t_{PLH}	Propagation Delay, CP_n to Q_n or $\overline{Q}_n$	5.0	4.0	7.5	11.0	4.0	13.0.	ns
t_{PHL}	Propagation Delay, CP_n to Q_n or $\overline{Q}_n$	5.0	3.5	6.0	10.0	3.0	11.5	ns

Note:

7. Voltage range 5.0 is 5.0V ± 0.5V.

AC Operating Requirements for ACT

Symbol	Parameter	V_{CC} (V)[9]	T_A = +25°C, C_L = 50pF	T_A = –40°C to +85°C, C_L = 50pF		Units
			Typ.	Guaranteed Minimum		
t_S	Set-up Time, HIGH or LOW, D_n to CP_n	5.0	1.0	3.0	3.5	ns
t_H	Hold Time, HIGH or LOW, D_n to CP_n	5.0	–0.5	1.0	1.0	ns
t_W	CP_n or $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ Pulse Width	5.0	3.0	5.0	6.0	ns
t_{rec}	Recovery Time, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to CP	5.0	–2.5	0	0	ns

Note:

8. Voltage range 5.0 is 5.0V ± 0.5V.

Capacitance

Symbol	Parameter	Conditions	Typ.	Units
C_{IN}	Input Capacitance	V_{CC} = OPEN	4.5	pF
C_{PD}	Power Dissipation Capacitance	V_{CC} = 5.0V	35.0	pF

Physical Dimensions

8.75
8.50

A

7.62

14   8

B

6.00

4.00
3.80

PIN ONE
INDICATOR

1   7

1.27

0.51
0.35

(0.33)

⊕ 0.25 Ⓜ C B A

0.65

5.60

1.70   1.27

LAND PATTERN RECOMMENDATION

1.75 MAX
1.50
1.25

0.25
0.10

C

◠ 0.10 C

SEE DETAIL A

0.25
0.19

NOTES: UNLESS OTHERWISE SPECIFIED

0.50
0.25   X 45°

R0.10

R0.10

GAGE PLANE

0.36

8°
0°

0.90

0.50

(1.04)

SEATING PLANE

DETAIL A
SCALE: 20:1
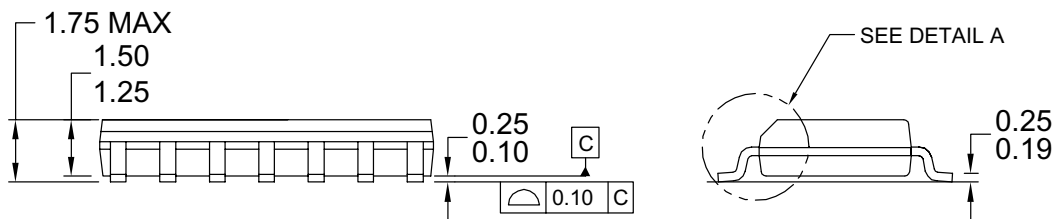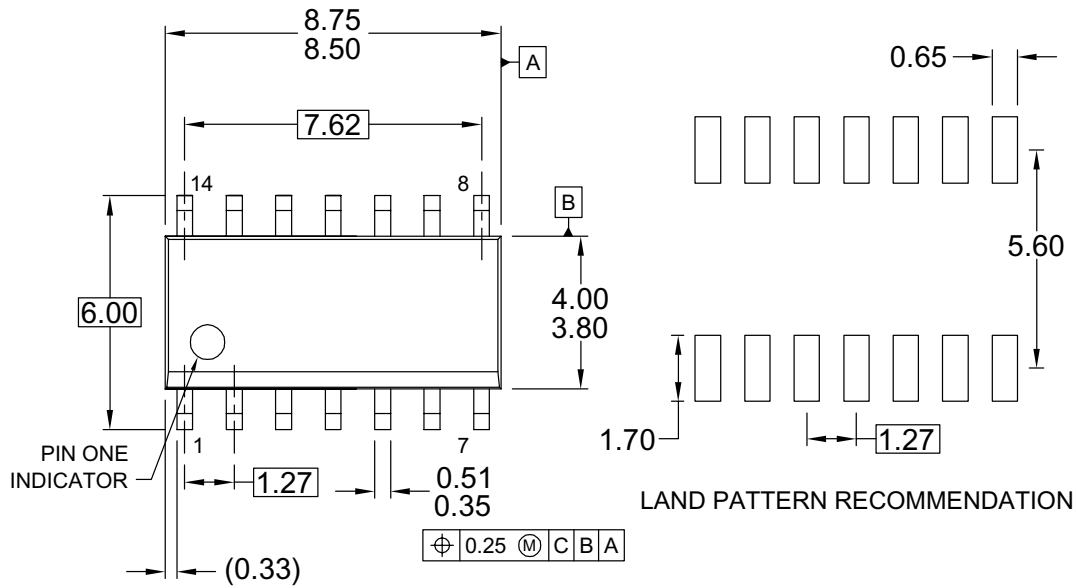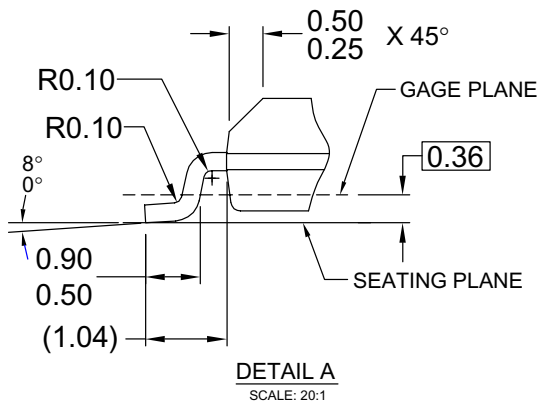
A) THIS PACKAGE CONFORMS TO JEDEC
    MS-012, VARIATION AB, ISSUE C,
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS DO NOT INCLUDE MOLD
    FLASH OR BURRS.
D) LANDPATTERN STANDARD:
    SOIC127P600X145-14M
E) DRAWING CONFORMS TO ASME Y14.5M-1994
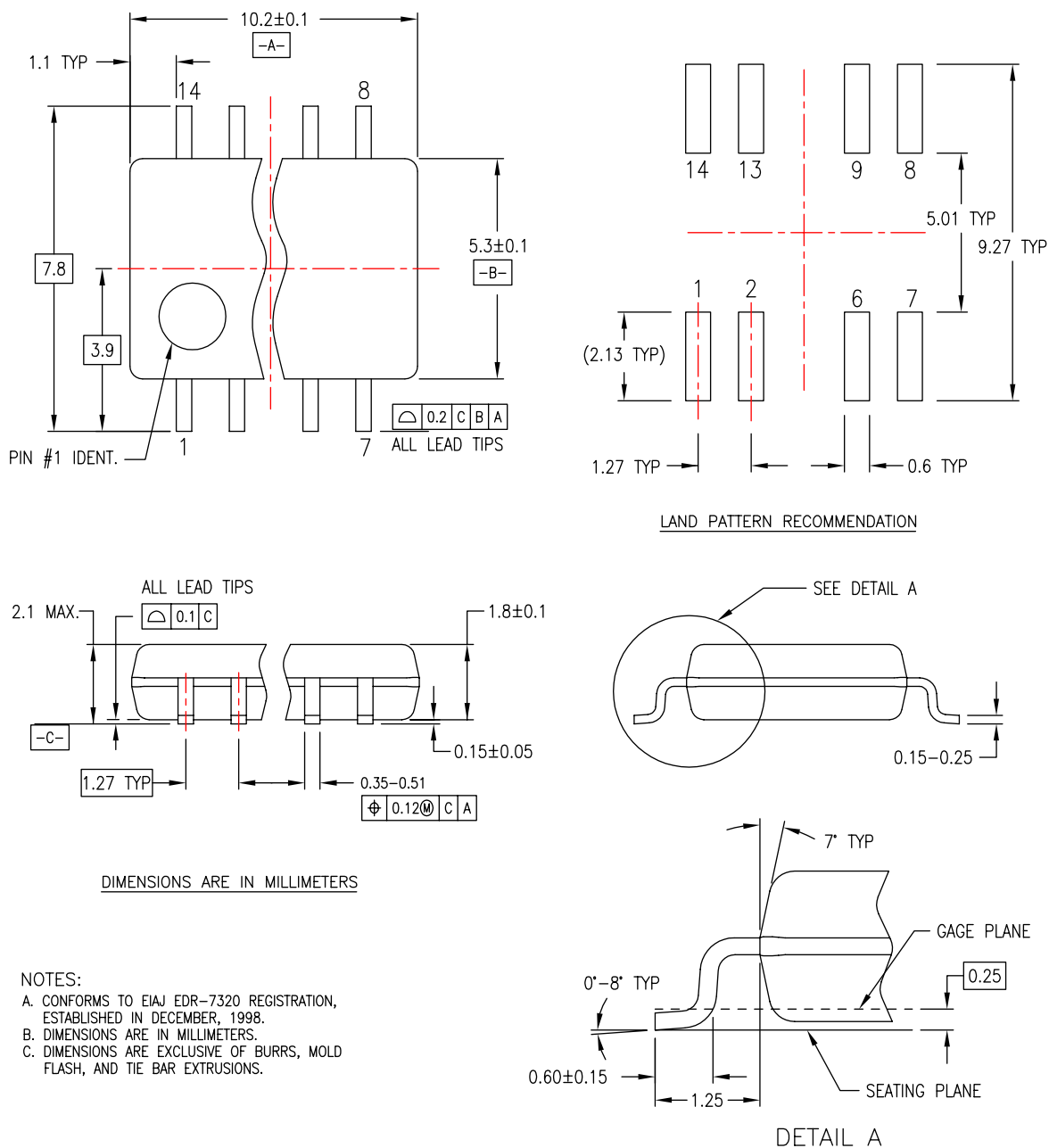F) DRAWING FILE NAME: M14AREV13

Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

http://www.fairchildsemi.com/packaging/

Physical Dimensions (Continued)

10.2±0.1
-A-

1.1 TYP

14   8

7.8

5.3±0.1
-B-

3.9

PIN #1 IDENT.

1   7

⌓ 0.2 C B A
ALL LEAD TIPS

LAND PATTERN RECOMMENDATION

14 13   9 8

5.01 TYP

9.27 TYP

1 2   6 7

(2.13 TYP)

1.27 TYP   0.6 TYP

ALL LEAD TIPS

⌓ 0.1 C

2.1 MAX.

1.8±0.1

-C-

0.15±0.05

1.27 TYP   0.35−0.51

⊕ 0.12Ⓜ C A

DIMENSIONS ARE IN MILLIMETERS

SEE DETAIL A

0.15−0.25

7° TYP

GAGE PLANE

0.25

0°−8° TYP

0.60±0.15

1.25

SEATING PLANE

DETAIL A

NOTES:
A. CONFORMS TO EIAJ EDR−7320 REGISTRATION,
   ESTABLISHED IN DECEMBER, 1998.
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD
   FLASH, AND TIE BAR EXTRUSIONS.

M14DREVC

Figure 2. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

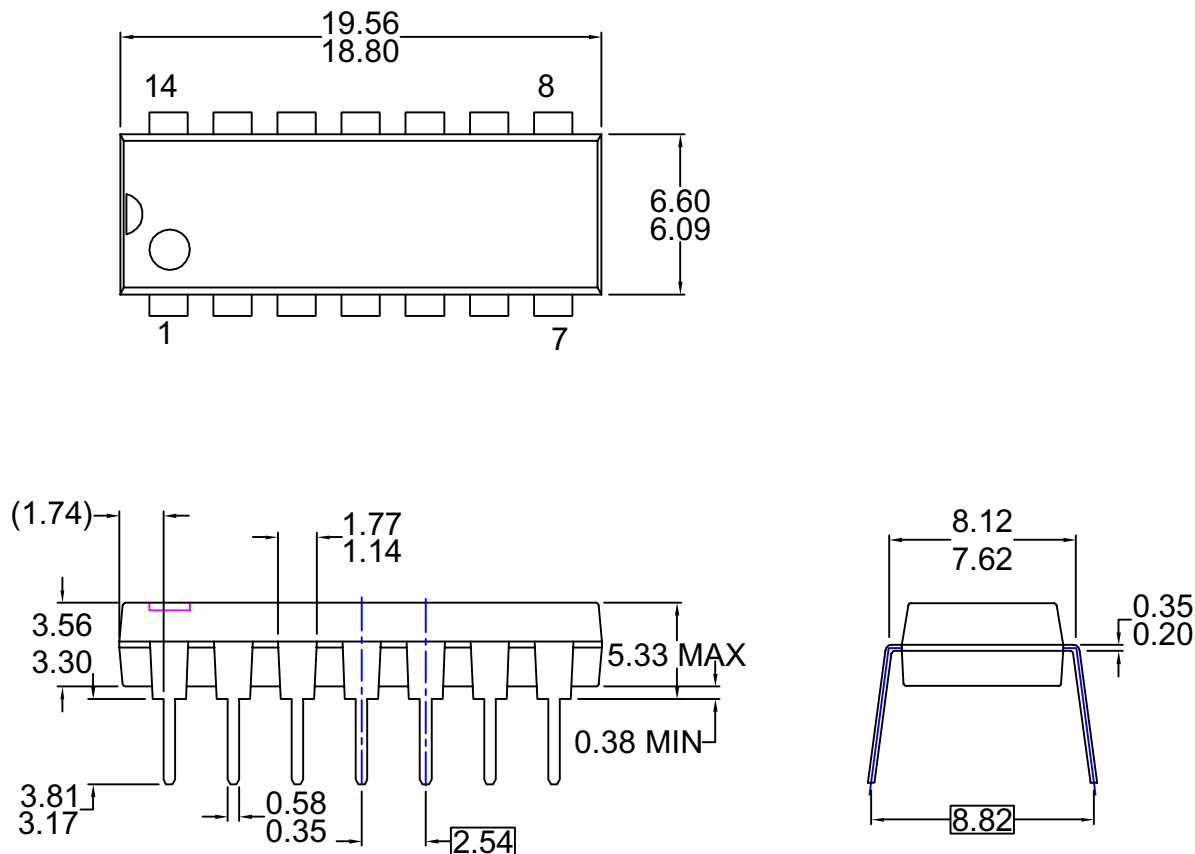*Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:*

http://www.fairchildsemi.com/packaging/

Physical Dimensions (Continued)

5.0±0.1
-A-

0.43 TYP

14   8

6.4

3.2

4.4±0.1
-B-

1

7

PIN #1 IDENT.

0.2 C B A
ALL LEAD TIPS

0.65

1.65

0.45

6.10

LAND PATTERN RECOMMENDATION

ALL LEAD TIPS
0.1 C

1.2 MAX

-C-

0.65

0.19 - 0.30

0.13 M A B S C S

0.90 +0.15 -0.10

0.10±0.05

SEE DETAIL A

0.09-0.20

12.00° TOP & BOTTOM

R0.09 min

GAGE PLANE

0.25

0°-8°

0.6±0.1

1.00

R0.09min

SEATING PLANE

DETAIL A
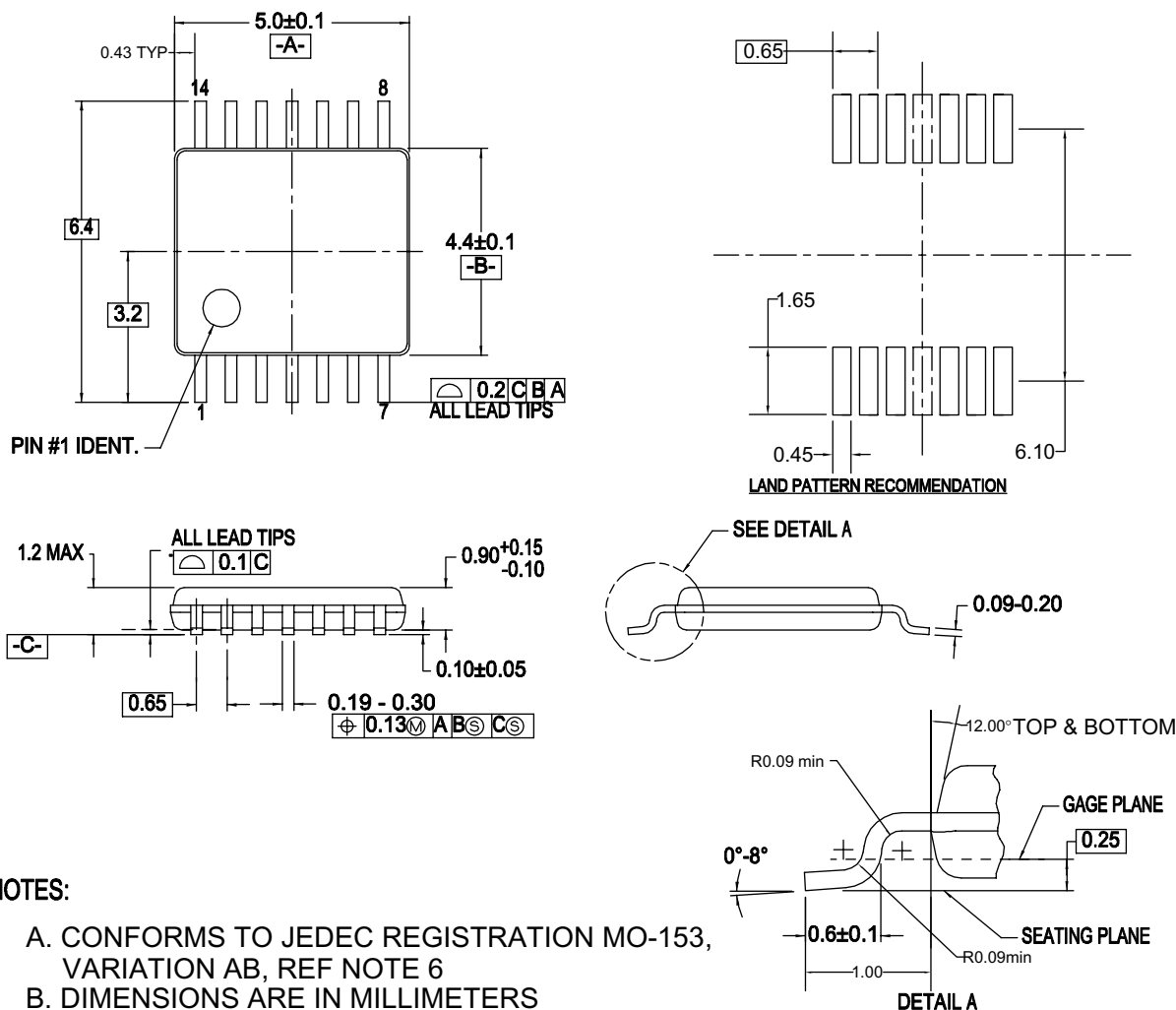
NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6

B. DIMENSIONS ARE IN MILLIMETERS

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS

D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982

E. LANDPATTERN STANDARD: SOP65P640X110-14M

F. DRAWING FILE NAME: MTC14REV6

Figure 3. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

http://www.fairchildsemi.com/packaging/

Physical Dimensions (Continued)

19.56
18.80

14   8

6.60
6.09

1   7

(1.74)

1.77
1.14

3.56
3.30

5.33 MAX

0.38 MIN

3.81
3.17

0.58
0.35

2.54

8.12
7.62

0.35
0.20

8.82

NOTES: UNLESS OTHERWISE SPECIFIED
    THIS PACKAGE CONFORMS TO
  A) JEDEC MS-001 VARIATION BA
  B) ALL DIMENSIONS ARE IN MILLIMETERS.
    DIMENSIONS ARE EXCLUSIVE OF BURRS,
  C) MOLD FLASH, AND TIE BAR EXTRUSIONS.
  D) DIMENSIONS AND TOLERANCES PER
    ASME Y14.5-1994
  E) DRAWING FILE NAME: MKT-N14AREV7

Figure 4. 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

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