FAIRCHILD SEMICONDUCTOR®

April 2007

74AC175, 74ACT175
Quad D-Type Flip-Flop

Features

- I_{CC} reduced by 50%
- Edge-triggered D-type inputs
- Buffered positive edge-triggered clock
- Asynchronous common reset
- True and complement output
- Outputs source/sink 24mA
- ACT175 has TTL-compatible inputs

General Description

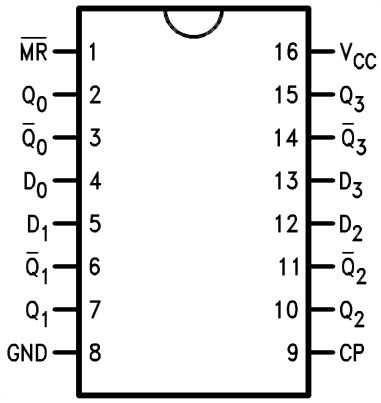
The AC/ACT175 is a high-speed quad D-type flip-flop. The device is useful for general flip-flop requirements where clock and clear inputs are common. The information on the D-type inputs is stored during the LOW-to-HIGH clock transition. Both true and complemented outputs of each flip-flop are provided. A Master Reset input resets all flip-flops, independent of the Clock or D-type inputs, when LOW.

Ordering Information

Order Number	Package Number	Package Description
74AC175SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body
74AC175SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74AC175MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74AC175PC	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
74ACT175SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body
74ACT175SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74ACT175MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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

Connection Diagram



Pin Descriptions

Pin Names	Description
D_0–D_3	Data Inputs
CP	Clock Pulse Input
$\overline{MR}$	Master Reset Input
Q_0–Q_3	True Outputs
$\overline{Q}_0$–$\overline{Q}_3$	Complement Outputs

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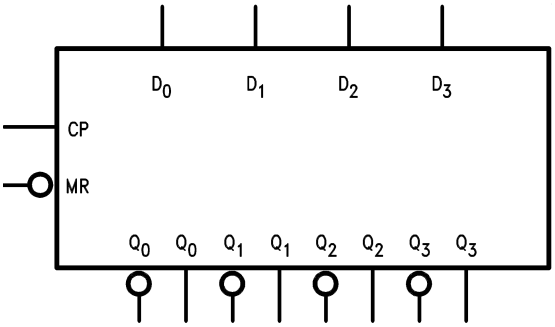
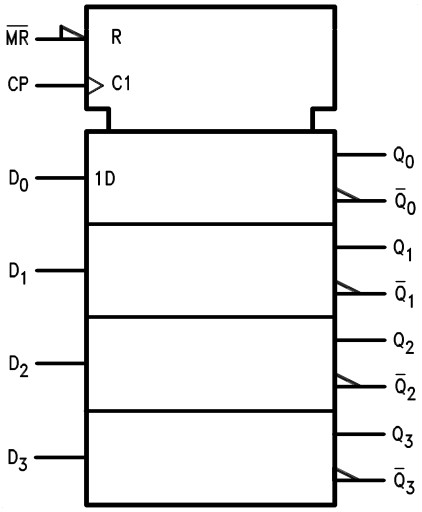
Logic Symbol



IEEE/IEC



Functional Description

The AC/ACT175 consists of four edge-triggered D-type flip-flops with individual D inputs and Q and $\overline{Q}$ outputs. The Clock and Master Reset are common. The four flip-flops will store the state of their individual D inputs on the LOW-to-HIGH clock (CP) transition, causing individual Q and $\overline{Q}$ outputs to follow. A LOW input on the Master Reset ($\overline{MR}$) will force all Q outputs LOW and $\overline{Q}$ outputs HIGH independent of Clock or Data inputs. The AC/ACT175 is useful for general logic applications where a common Master Reset and Clock are acceptable.

Truth Table

Inputs @ t_n, $\overline{MR}$ = H	Outputs @ t_{n+1}	
D_n	Q_n	$\overline{Q}_n$
L	L	H
H	H	L

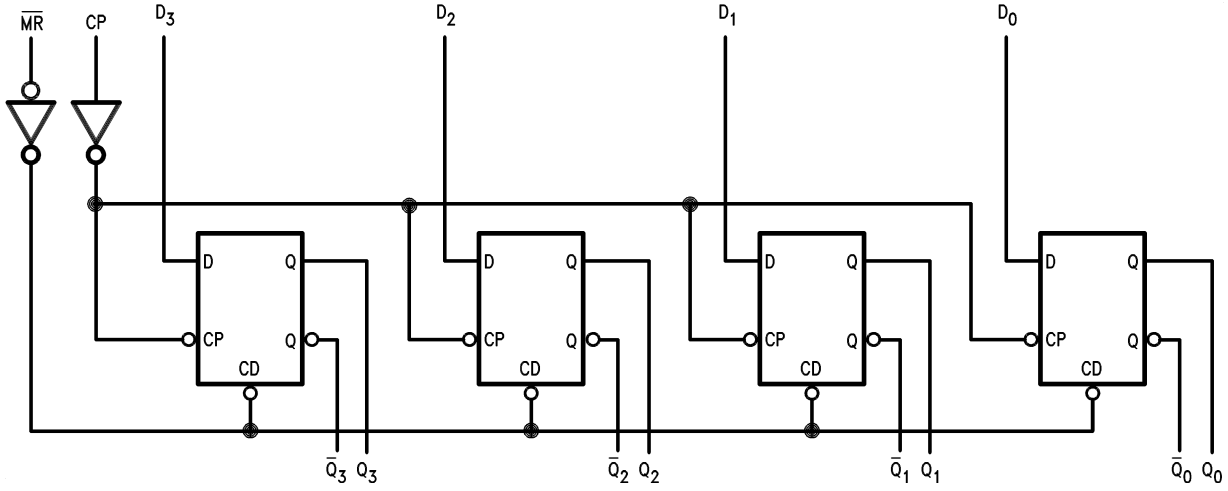
H = HIGH Voltage Level

L = LOW Voltage Level

t_n = Bit Time before Clock Pulse

t_{n+1} = Bit Time after Clock Pulse

Logic Diagram



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

Figure 1.

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
	$V_I = V_{CC} + 0.5V$	+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:	125mV/ns
	V_{IN} from 30% to 70% of V_{CC}, V_{CC} @ 3.3V, 4.5V, 5.5V	
$\Delta V / \Delta t$	Minimum Input Edge Rate, ACT Devices:	125mV/ns
	V_{IN} from 0.8V to 2.0V, V_{CC} @ 4.5V, 5.5V	

DC Electrical Characteristics for AC

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C	T_A = –40°C to +85°C		Units
				Typ.	Guaranteed Limits		
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	I_{OH} = –24mA		3.86	3.76	
		5.5	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	I_{OL} = 24mA		0.36	0.44	
		5.5	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		4.0	40.0	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	T_A = –40°C to +85°C		Units
				Typ.	Guaranteed Limits		
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} = –50μA	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	I_{OH} = –24mA[4]		4.86	4.76	
V_{OL}	Maximum LOW Level Output Voltage	4.5	I_{OUT} = 50μA	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	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		4.0	40.0	μA

Notes:

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

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

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	149	214		139		MHz
		5.0	187	244		187		
t_{PLH}	Propagation Delay, CP to Q_n or $\overline{Q}_n$	3.3	2.0	9.5	12.0	2.0	13.5	ns
		5.0	1.5	7.0	9.0	1.0	9.5	
t_{PHL}	Propagation Delay, CP to Q_n or $\overline{Q}_n$	3.3	2.5	8.5	13.0	2.0	14.5	ns
		5.0	1.5	6.0	9.5	1.5	10.5	
t_{PLH}	Propagation Delay, $\overline{MR}$ to $\overline{Q}_n$	3.3	3.0	7.5	12.5	2.5	13.5	ns
		5.0	2.0	5.5	9.0	1.5	10.0	
t_{PHL}	Propagation Delay, $\overline{MR}$ to Q_n	3.3	3.0	8.5	11.0	2.5	12.5	ns
		5.0	2.0	6.0	8.5	1.5	9.0	

Note:

6. 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 = 50pF		Units
			Typ.	Guaranteed Minimum		
t_S	Setup Time, HIGH or LOW, D_n to CP	3.3	2.0	4.5	4.5	ns
		5.0	1.0	3.0	3.0	
t_H	Hold Time, HIGH or LOW, D_n to CP	3.3	1.0	1.0	1.0	ns
		5.0	1.0	1.0	1.0	
t_W	CP Pulse Width, HIGH or LOW	3.3	2.5	4.5	4.5	ns
		5.0	2.0	3.5	3.5	
t_W	$\overline{MR}$ Pulse Width, LOW	3.3	2.5	4.5	5.0	ns
		5.0	2.0	3.5	3.5	
t_{REC}	Recovery Time, $\overline{MR}$ to CP	3.3	–2.0	0	0	ns
		5.0	–1.0	0	0	

Note:

7. 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	175	236		145		MHz
t_{PLH}	Propagation Delay, CP to Q_n or $\overline{Q}_n$	5.0	2.0	6.0	10.0	1.5	11.0	ns
t_{PHL}	Propagation Delay, CP to Q_n or $\overline{Q}_n$	5.0	2.0	7.0	11.0	1.5	12.0	ns
t_{PLH}	Propagation Delay, $\overline{MR}$ to $\overline{Q}_n$	5.0	2.0	6.0	9.5	1.5	10.5	ns
t_{PHL}	Propagation Delay, $\overline{MR}$ to Q_n	5.0	2.0	5.5	9.5	1.5	10.5	ns

Note:

8. 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 (H)	Setup Time, D_n to CP	5.0	3.0	2.0	2.0	ns
t_S (L)			3.0	2.5	2.5	
t_H	Hold Time, HIGH or LOW, D_n to CP	5.0	0	1.0	1.0	ns
t_W	CP Pulse Width,HIGH or LOW	5.0	4.0	3.0	3.5	ns
t_W	$\overline{MR}$ Pulse Width, LOW	5.0	4.0	3.0	4.0	ns
t_{rec}	Recovery Time, $\overline{MR}$ to CP	5.0	0	0	0	ns

Note:

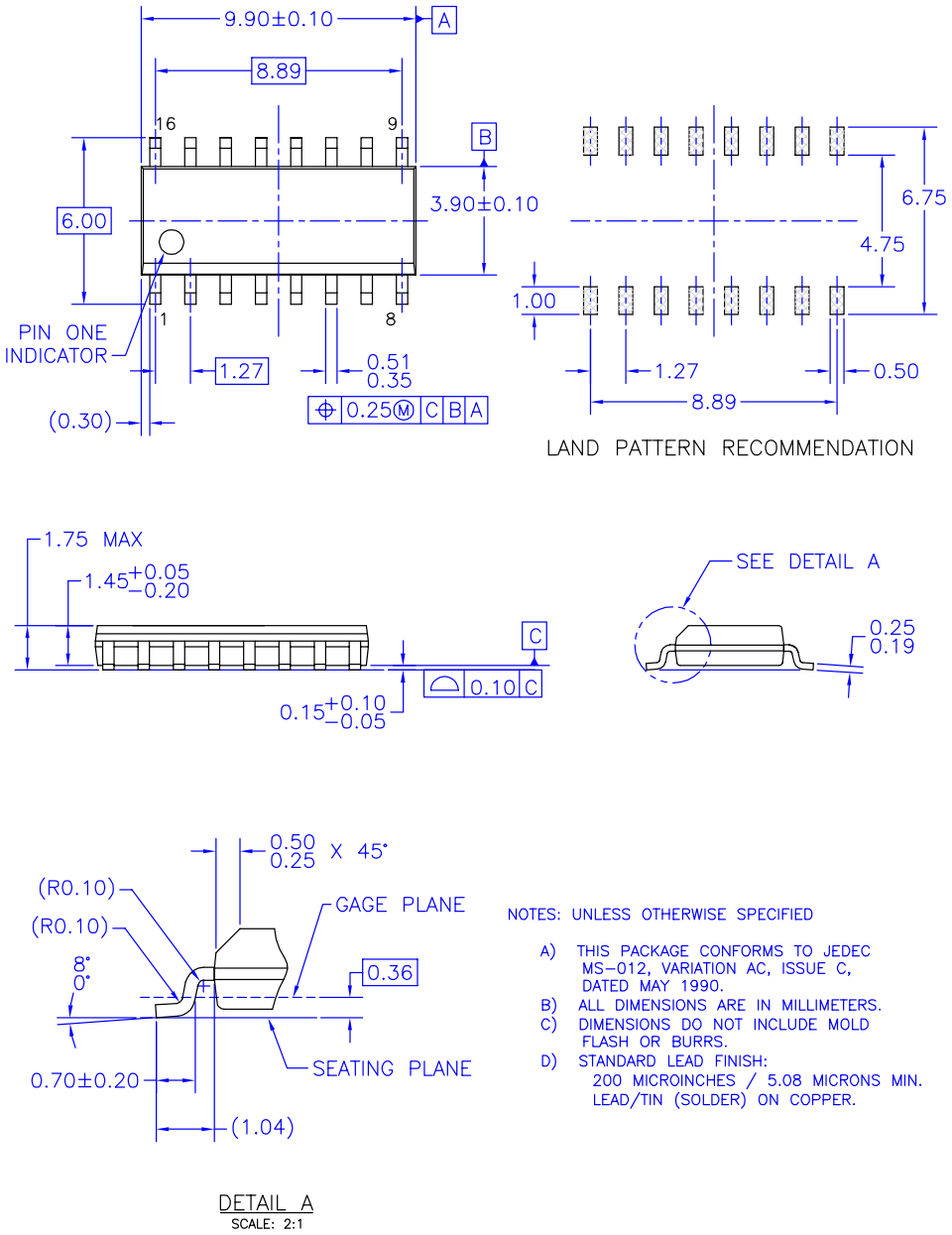
9. Voltage Range 5.0 is 5.0V ± 0.5V.

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	45.0	pF

Physical Dimensions

Dimensions are in millimeters unless otherwise noted.



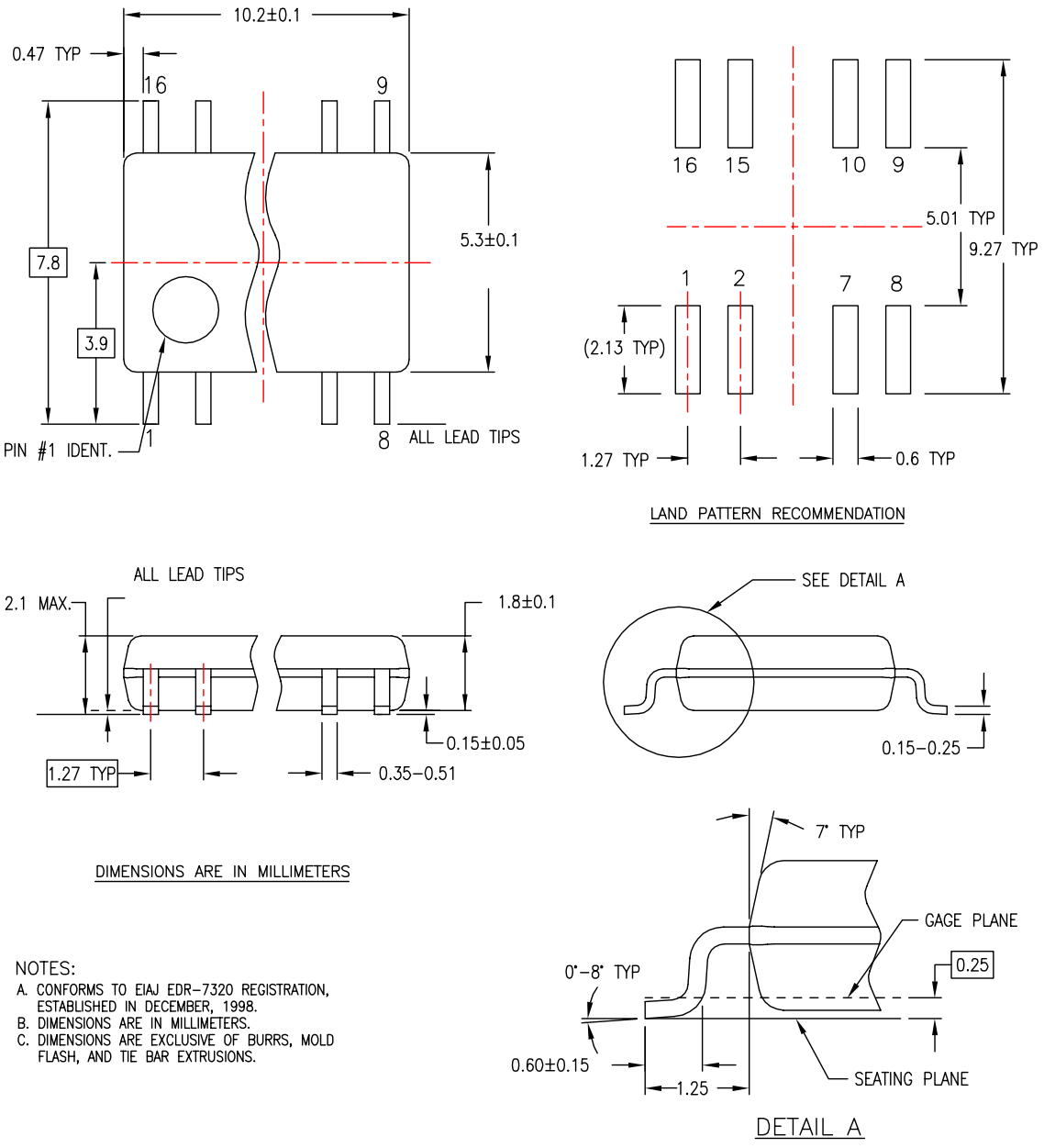
NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AC, ISSUE C, DATED MAY 1990.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
D) STANDARD LEAD FINISH: 200 MICROINCHES / 5.08 MICRONS MIN. LEAD/TIN (SOLDER) ON COPPER.

Figure 2. 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M16A

Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.



NOTES:

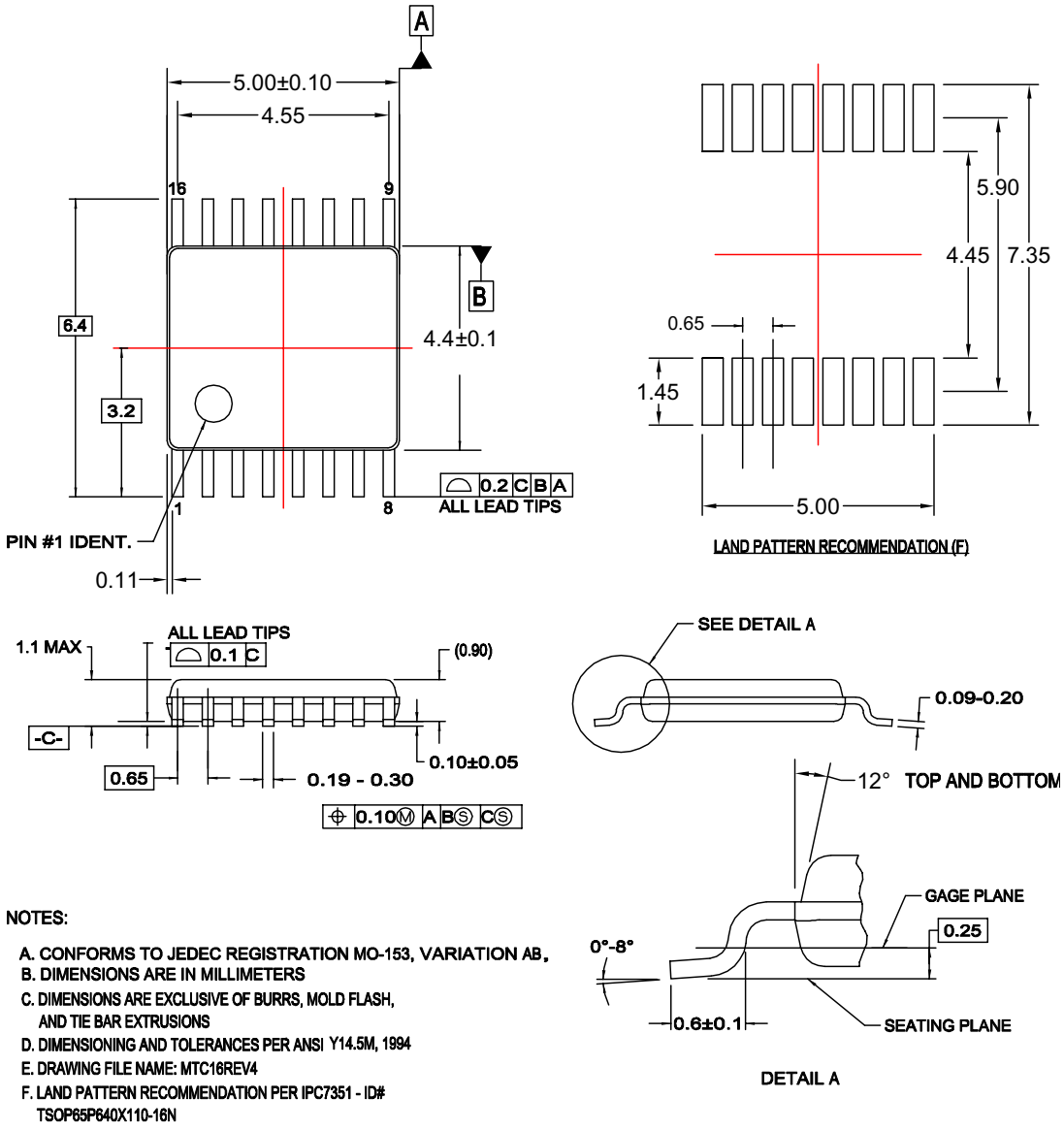
A. CONFORMS TO EIAJ EDR–7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M16DREVC

Figure 3. 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D

Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.



NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB,
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, 1994
E. DRAWING FILE NAME: MTC16REV4
F. LAND PATTERN RECOMMENDATION PER IPC7351 - ID# TSOP65P640X110-16N

MTC16rev4

Figure 4. 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC16

Physical Dimensions (Continued)

Dimensions are in inches (millimeters) unless otherwise noted.

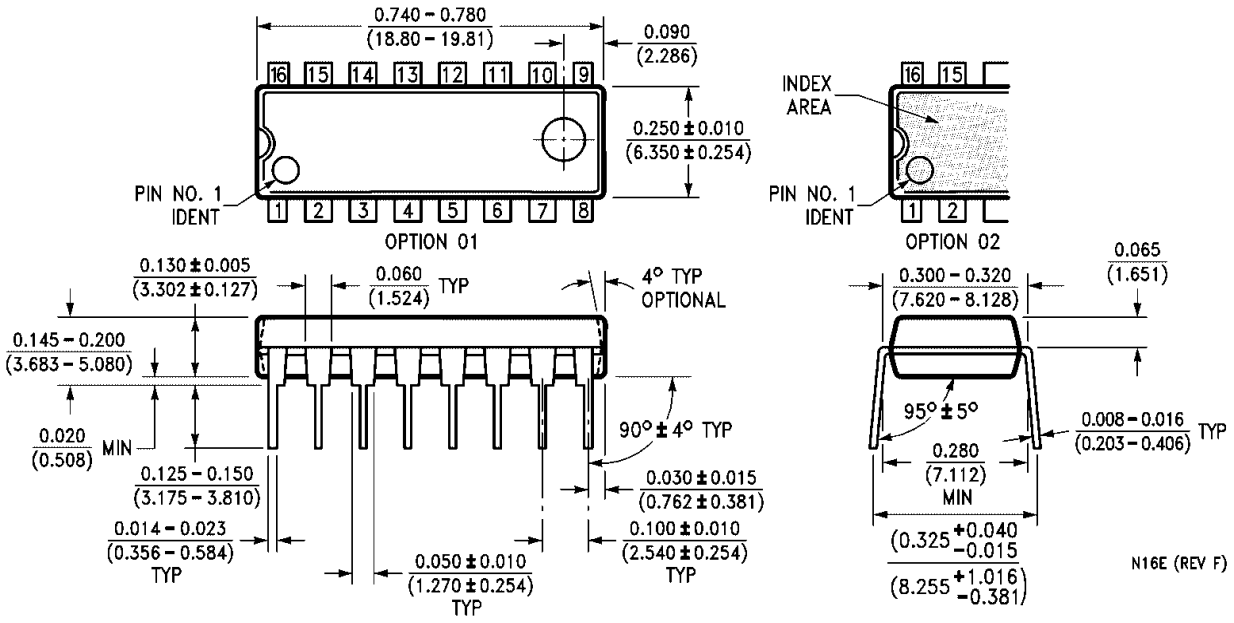


Figure 5. 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
Package Number N16E

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SuperSOT™-6
SuperSOT™-8
SyncFET™
TCM™
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