FAIRCHILD SEMICONDUCTOR™

November 1988
Revised November 1999

74AC174 • 74ACT174
Hex D-Type Flip-Flop with Master Reset

General Description

The AC/ACT174 is a high-speed hex D-type flip-flop. The device is used primarily as a 6-bit edge-triggered storage register. The information on the D inputs is transferred to storage during the LOW-to-HIGH clock transition. The device has a Master Reset to simultaneously clear all flip-flops.

Features

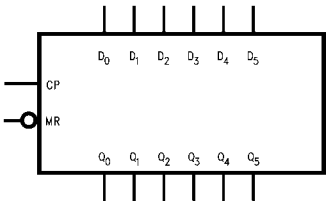
- I_{CC} reduced by 50%
- Outputs source/sink 24 mA
- ACT174 has TTL-compatible inputs

Ordering Code:

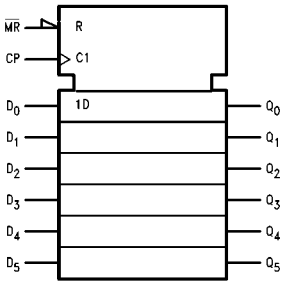
Order Number	Package Number	Package Description
74AC174SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body
74AC174SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74AC174PC	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
74ACT174SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74ACT174SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74ACT174MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74ACT174PC	N16E	16-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 code.

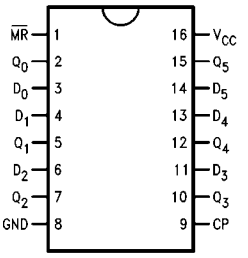
Logic Symbols



IEEE/IEC



Connection Diagram



Pin Descriptions

Pin Names	Description
D_0–D_5	Data Inputs
CP	Clock Pulse Input
$\overline{MR}$	Master Reset Input
Q_0–Q_5	Outputs

FACT™ is a trademark of Fairchild Semiconductor Corporation.

Functional Description

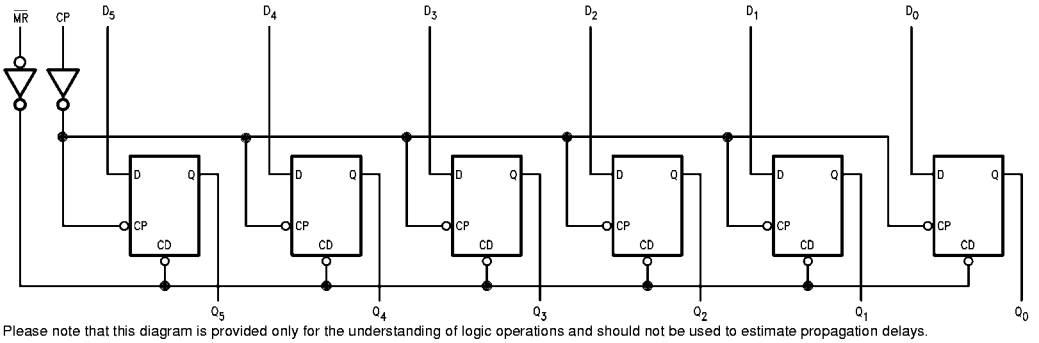
The AC/ACT174 consists of six edge-triggered D-type flip-flops with individual D inputs and Q outputs. The Clock (CP) and Master Reset ($\overline{MR}$) are common to all flip-flops. Each D input's state is transferred to the corresponding flip-flop's output following the LOW-to-HIGH Clock (CP) transition. A LOW input to the Master Reset ($\overline{MR}$) will force all outputs LOW independent of Clock or Data inputs. The AC/ACT174 is useful for applications where the true output only is required and the Clock and Master Reset are common to all storage elements.

Truth Table

Inputs			Output
$\overline{MR}$	CP	D	Q
L	X	X	L
H	↑	H	H
H	↑	L	L
H	L	X	Q

H = HIGH Voltage Level
L = LOW Voltage Level
↑ = LOW-to-HIGH Transition
X = Immaterial

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.

Absolute Maximum Ratings(Note 1)

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

Recommended Operating Conditions

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

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation of FACT™ circuits outside databook specifications.

DC Electrical Characteristics for AC

Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$ Typ	$T_A = -40°C$ to $+85°C$ Guaranteed Limits		Units	Conditions
V_{IH}	Minimum HIGH Level Input Voltage	3.0	1.5	2.1	2.1	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		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	1.5	0.9	0.9	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		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	2.99	2.9	2.9	V	$I_{OUT} = -50\ \mu A$
		4.5	4.49	4.4	4.4		
		5.5	5.49	5.4	5.4		
							$V_{IN} = V_{IL}$ or V_{IH}
		3.0		2.56	2.46	V	$I_{OH} = -12$ mA
		4.5		3.86	3.76		$I_{OH} = -24$ mA
		5.5		4.86	4.76		$I_{OH} = -24$ mA (Note 2)
V_{OL}	Maximum LOW Level Output Voltage	3.0	0.002	0.1	0.1	V	$I_{OUT} = 50\ \mu A$
		4.5	0.001	0.1	0.1		
		5.5	0.001	0.1	0.1		
							$V_{IN} = V_{IL}$ or V_{IH}
		3.0		0.36	0.44	V	$I_{OL} = 12$ mA
		4.5		0.36	0.44		$I_{OL} = 24$ mA
		5.5		0.36	0.44		$I_{OL} = 24$ mA (Note 2)
I_{IN} (Note 4)	Maximum Input Leakage Current	5.5		±0.1	±1.0	µA	$V_I = V_{CC}$ or GND
I_{OLD}	Minimum Dynamic Output Current (Note 3)	5.5			75	mA	$V_{OLD} = 1.65V$ Max
I_{OHD}		5.5			−75	mA	$V_{OHD} = 3.85V$ Min
I_{CC} (Note 4)	Maximum Quiescent Supply Current	5.5		4.0	40.0	µA	$V_{IN} = V_{CC}$ or GND

Note 2: All outputs loaded; thresholds on input associated with output under test.

Note 3: Maximum test duration 2.0 ms, one output loaded at a time.

Note 4: 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}	$T_A = +25°C$	$T_A = -40°C$ to $+85°C$		Units	Conditions
		(V)	Typ	Guaranteed Limits			
V_{IH}	Minimum HIGH Level	4.5	1.5	2.0	2.0	V	$V_{OUT} = 0.1V$
	Input Voltage	5.5	1.5	2.0	2.0		or $V_{CC} - 0.1V$
V_{IL}	Maximum LOW Level	4.5	1.5	0.8	0.8	V	$V_{OUT} = 0.1V$
	Input Voltage	5.5	1.5	0.8	0.8		or $V_{CC} - 0.1V$
V_{OH}	Minimum HIGH Level	4.5	4.49	4.4	4.4	V	$I_{OUT} = -50\ \mu A$
	Output Voltage	5.5	5.49	5.4	5.4		
							$V_{IN} = V_{IL}$ or V_{IH}
		4.5		3.86	3.76	V	$I_{OH} = -24$ mA
		5.5		4.86	4.76		$I_{OH} = -24$ mA (Note 5)
V_{OL}	Maximum LOW Level	4.5	0.001	0.1	0.1	V	$I_{OUT} = 50\ \mu A$
	Output Voltage	5.5	0.001	0.1	0.1		
							$V_{IN} = V_{IL}$ or V_{IH}
		4.5		0.36	0.44	V	$I_{OL} = 24$ mA
		5.5		0.36	0.44		$I_{OL} = 24$ mA (Note 5)
I_{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	μA	$V_I = V_{CC}$, GND
I_{CCT}	Maximum I_{CC}/Input	5.5	0.6		1.5	mA	$V_I = V_{CC} - 2.1V$
I_{OLD}	Minimum Dynamic	5.5			75	mA	$V_{OLD} = 1.65V$ Max
I_{OHD}	Output Current (Note 6)	5.5			−75	mA	$V_{OHD} = 3.85V$ Min
I_{CC}	Maximum Quiescent Supply Current	5.5		4.0	40.0	μA	$V_{IN} = V_{CC}$ or GND

Note 5: All outputs loaded; thresholds on input associated with output under test.

Note 6: Maximum test duration 2.0 ms, one output loaded at a time.

AC Electrical Characteristics for AC

Symbol	Parameter	V_{CC} (V) (Note 7)	$T_A = +25°C$, $C_L = 50$ pF			$T_A = -40°C$ to $+85°C$, $C_L = 50$ pF		Units
			Min	Typ	Max	Min	Max	
f_{MAX}	Maximum Clock	3.3	90	100		70		MHz
	Frequency	5.0	100	125		100		
t_{PLH}	Propagation Delay	3.3	2.0	9.0	11.5	1.5	12.5	ns
	CP to Q_n	5.0	1.5	6.0	8.5	1.0	9.5	
t_{PHL}	Propagation Delay	3.3	2.0	8.5	11.0	1.5	12.0	ns
	CP to Q_n	5.0	1.5	6.0	8.0	1.0	9.0	
t_{PHL}	Propagation Delay	3.3	2.5	9.0	11.5	2.0	12.5	ns
	$\overline{MR}$ to Q_n	5.0	1.5	7.0	9.0	1.5	10.5	

Note 7: 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) (Note 8)	$T_A = +25°C$, $C_L = 50$ pF		$T_A = -40°C$ to $+85°C$, $C_L = 50$ pF	Units
			Typ	Guaranteed Minimum		
t_S	Setup Time, HIGH or LOW	3.3	2.5	6.5	7.0	ns
	D_n to CP	5.0	2.0	5.0	5.5	
t_H	Hold Time, HIGH or LOW	3.3	1.0	3.0	3.0	ns
	D_n to CP	5.0	0.5	3.0	3.0	
t_W	$\overline{MR}$ Pulse Width, LOW	3.3	1.0	5.5	7.0	ns
		5.0	1.0	5.0	5.0	
t_W	CP Pulse Width	3.3	1.0	5.5	7.0	ns
		5.0	1.0	5.0	5.0	
t_{REC}	Recovery Time	3.3	0	2.5	2.5	ns
	$\overline{MR}$ to CP	5.0	0	2.0	2.0	

Note 8: 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) (Note 9)	$T_A = +25°C$, $C_L = 50$ pF			$T_A = -40°C$ to $+85°C$, $C_L = 50$ pF		Units
			Min	Typ	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency	5.0	165	200		140		MHz
t_{PLH}	Propagation Delay CP to Q_n	5.0	1.5	7.0	10.5	1.5	11.5	ns
t_{PHL}	Propagation Delay CP to Q_n	5.0	1.5	7.0	10.5	1.5	11.5	ns
t_{PHL}	Propagation Delay $\overline{MR}$ to Q_n	5.0	1.5	6.5	9.5	1.5	11.0	ns

Note 9: Voltage Range 5.0 is 5.0V ± 0.5V

AC Operating Requirements for ACT

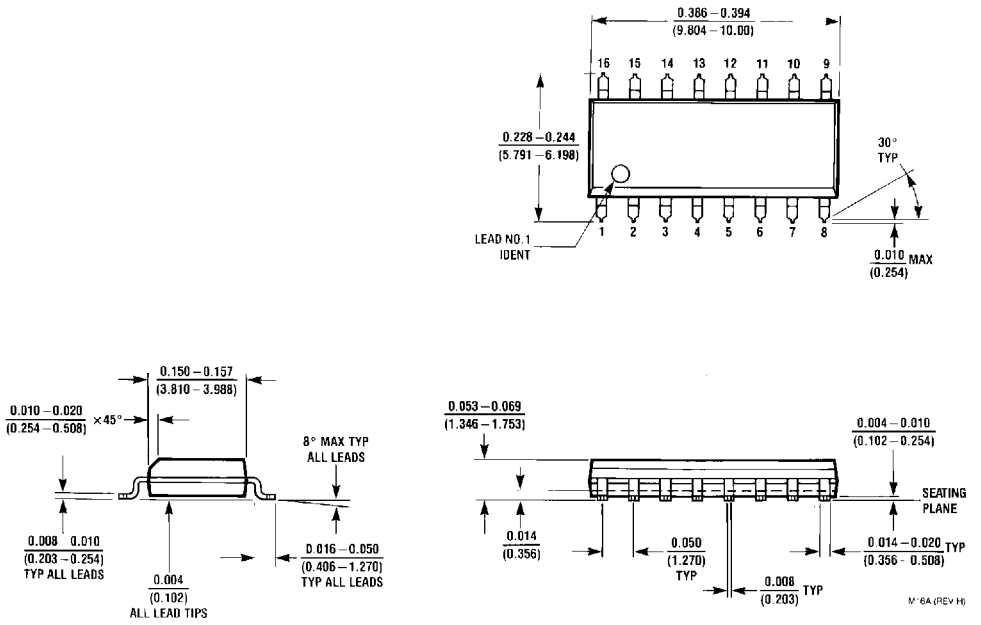
Symbol	Parameter	V_{CC} (V) (Note 10)	$T_A = +25°C$, $C_L = 50$ pF		$T_A = -40°C$ to $+85°C$, $C_L = 50$ pF	Units
			Typ	Guaranteed Minimum		
t_S	Setup Time, HIGH or LOW D_n to CP	5.0	0.5	1.5	1.5	ns
t_H	Hold Time, HIGH or LOW D_n to CP	5.0	1.0	2.0	2.0	ns
t_W	$\overline{MR}$ Pulse Width, LOW	5.0	1.5	3.0	3.5	ns
t_W	CP Pulse Width, HIGH or LOW	5.0	1.5	3.0	3.5	ns
t_{rec}	Recovery Time $\overline{MR}$ to CP	5.0	−1.0	0.5	0.5	ns

Note 10: Voltage Range 5.0 is 5.0V ± 0.5V

Capacitance

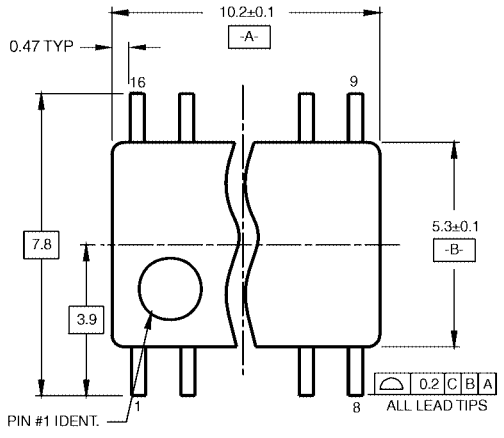
Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	4.5	pF	V_{CC} = OPEN
C_{PD}	Power Dissipation Capacitance	85.0	pF	V_{CC} = 5.0V

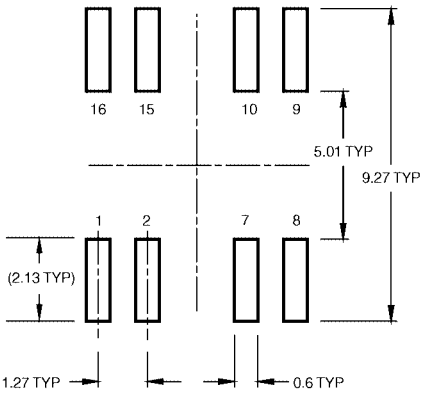
Physical Dimensions inches (millimeters) unless otherwise noted



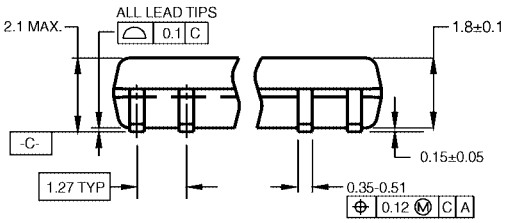
16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body
Package Number M16A

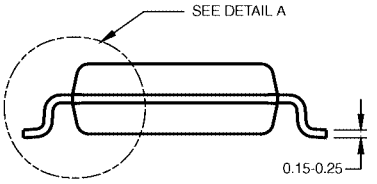
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



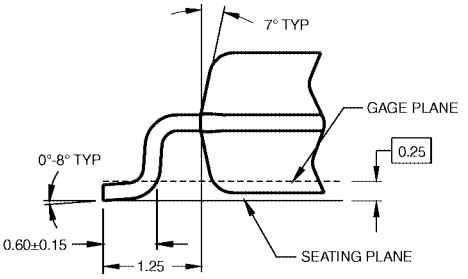


LAND PATTERN RECOMMENDATION





DIMENSIONS ARE IN MILLIMETERS



DETAIL A

NOTES:

A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.

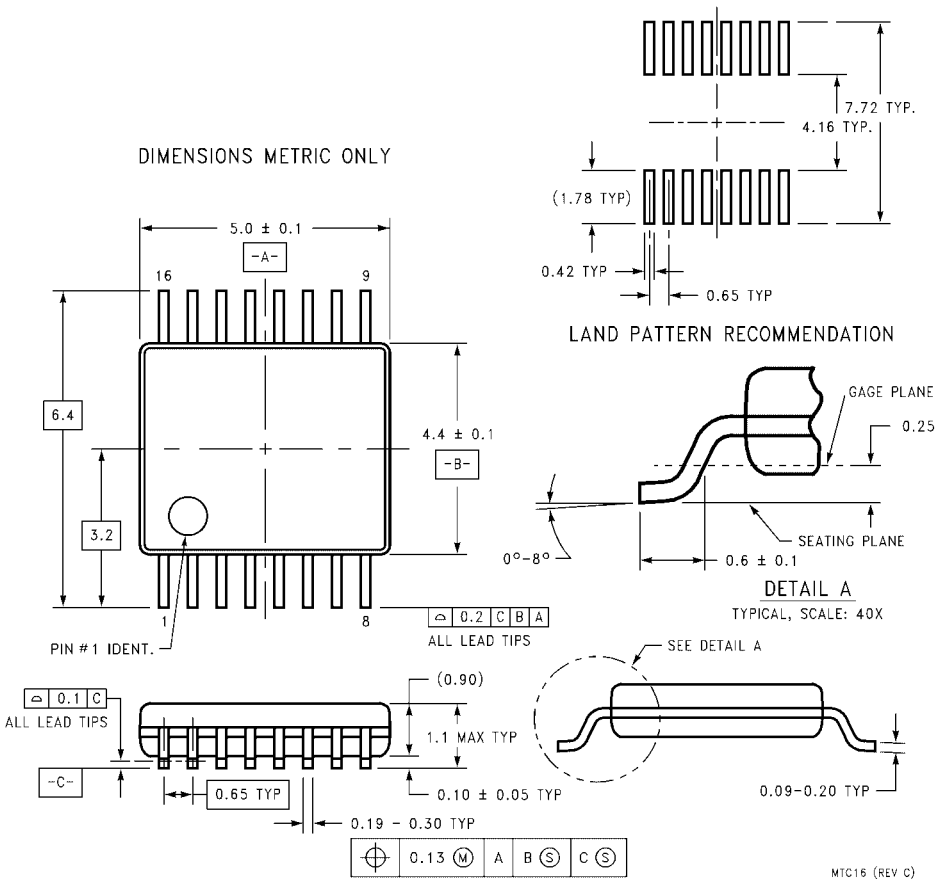
B. DIMENSIONS ARE IN MILLIMETERS.

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

M16DRevB1

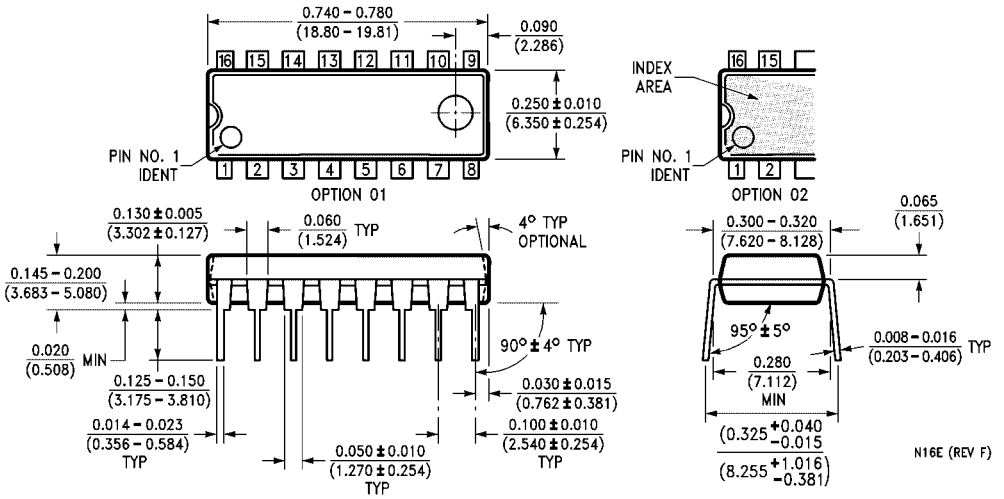
16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D

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



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

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



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