FAIRCHILD SEMICONDUCTOR™

November 1988
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74AC157 • 74ACT157
Quad 2-Input Multiplexer

General Description

The AC/ACT157 is a high-speed quad 2-input multiplexer. Four bits of data from two sources can be selected using the common Select and Enable inputs. The four outputs present the selected data in the true (noninverted) form. The AC/ACT157 can also be used as a function generator.

Features

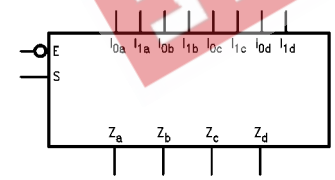
- I_{CC} and I_{OZ} reduced by 50%
- Outputs source/sink 24 mA
- ACT157 has TTL-compatible inputs

Ordering Code:

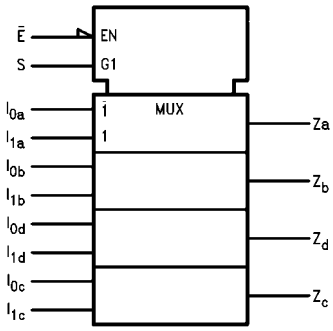
Order Number	Package Number	Package Description
74AC157SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body
74AC157SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74AC157MTC	MTC16	16 -Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74AC157PC	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
74ACT157SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body
74ACT157SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74ACT157MTC	MTC16	16 -Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74ACT157PC	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.

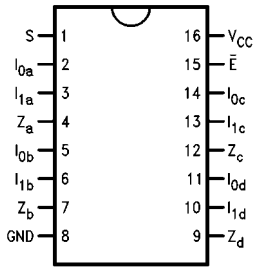
Logic Symbols



IEEE/IEC



Connection Diagram



Pin Descriptions

Pin Names	Description
I_{0a}–I_{0d}	Source 0 Data Inputs
I_{1a}–I_{1d}	Source 1 Data Inputs
$\overline{E}$	Enable Input
S	Select Input
Z_a–Z_d	Outputs

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Functional Description

The AC/ACT157 is a quad 2-input multiplexer. It selects four bits of data from two sources under the control of a common Select input (S). The Enable input ($\overline{E}$) is active-LOW. When $\overline{E}$ is HIGH, all of the outputs (Z) are forced LOW regardless of all other inputs. The AC/ACT157 is the logic implementation of a 4-pole, 2-position switch where the position of the switch is determined by the logic levels supplied to the Select input. The logic equations for the outputs are shown below:

$$Z_a = \overline{E} \bullet (I_{1a} \bullet S + I_{0a} \bullet \overline{S})$$
$$Z_b = \overline{E} \bullet (I_{1b} \bullet S + I_{0b} \bullet \overline{S})$$
$$Z_c = \overline{E} \bullet (I_{1c} \bullet S + I_{0c} \bullet \overline{S})$$
$$Z_d = \overline{E} \bullet (I_{1d} \bullet S + I_{0d} \bullet \overline{S})$$

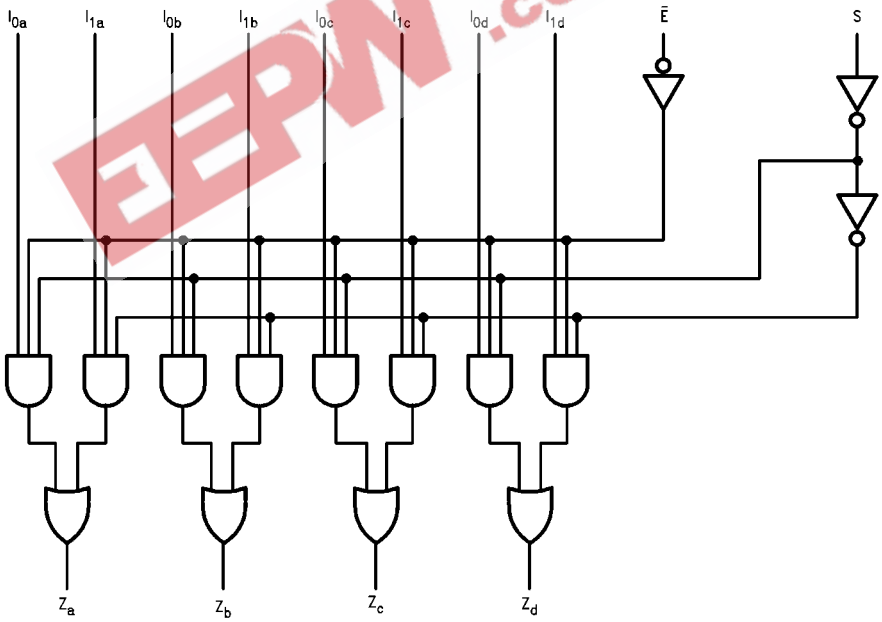
A common use of the AC/ACT157 is the moving of data from two groups of registers to four common output busses. The particular register from which the data comes is determined by the state of the Select input. A less obvious use is as a function generator. The AC/ACT157 can generate any four of the sixteen different functions of two variables with one variable common. This is useful for implementing gating functions.

Truth Table

Inputs				Outputs
$\overline{E}$	S	I_0	I_1	Z
H	X	X	X	L
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	H

H = HIGH Voltage Level
L = LOW Voltage Level
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_O = 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 (ΔV/Δt)	
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 (ΔV/Δt)	
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 μA
		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		I_{OH} = −12 mA
		4.5		3.86	3.76	V	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 μA
		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		I_{OL} = 12 mA
		4.5		0.36	0.44	V	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}, 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 Characteristics for ACT

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	4.5	1.5	2.0	2.0	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		5.5	1.5	2.0	2.0		
V_{IL}	Maximum LOW Level Input Voltage	4.5	1.5	0.8	0.8	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		5.5	1.5	0.8	0.8		
V_{OH}	Minimum HIGH Level Output Voltage	4.5	4.49	4.4	4.4	V	$I_{OUT} = -50\ \mu A$
		5.5	5.49	5.4	5.4		
		4.5		3.86	3.76	V	$V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = -24$ mA
		5.5		4.86	4.76		$I_{OH} = -24$ mA (Note 5)
V_{OL}	Maximum LOW Level Output Voltage	4.5	0.001	0.1	0.1	V	$I_{OUT} = 50\ \mu A$
		5.5	0.001	0.1	0.1		
		4.5		0.36	0.44	V	$V_{IN} = V_{IL}$ or V_{IH} $I_{OL} = 24$ 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 Output Current (Note 6)	5.5			75	mA	$V_{OLD} = 1.65V$ Max
I_{OHD}		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 Min	Typ	Max	$T_A = -40°C$ to $+85°C$, $C_L = 50$ pF Min	Max	Units
t_{PLH}	Propagation Delay S to Z_n	3.3	1.5	7.0	11.5	1.5	13.0	ns
		5.0	1.5	5.5	9.0	1.5	10.0	
t_{PHL}	Propagation Delay S to Z_n	3.3	1.5	6.5	11.0	1.5	12.0	ns
		5.0	1.5	5.0	8.5	1.0	9.5	
t_{PLH}	Propagation Delay $\overline{E}$ to Z_n	3.3	1.5	7.0	11.5	1.5	13.0	ns
		5.0	1.5	5.5	9.0	1.5	10.0	
t_{PHL}	Propagation Delay $\overline{E}$ to Z_n	3.3	1.5	6.5	11.0	1.5	12.0	ns
		5.0	1.5	5.5	9.0	1.0	9.5	
t_{PLH}	Propagation Delay I_n to Z_n	3.3	1.5	5.0	8.5	1.0	9.0	ns
		5.0	1.5	4.0	6.5	1.0	7.0	
t_{PHL}	Propagation Delay I_n to Z_n	3.3	1.5	5.0	8.0	1.0	9.0	ns
		5.0	1.5	4.0	6.5	1.0	7.0	

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

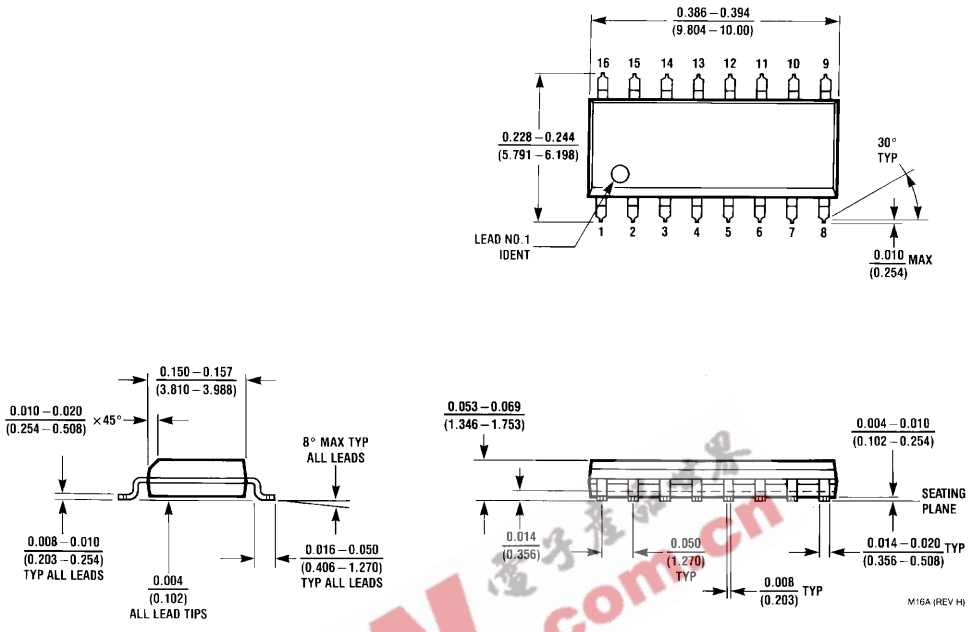
Symbol	Parameter	V_{CC} (V) (Note 8)	$T_A = +25°C$, $C_L = 50$ pF			$T_A = -40°C$ to $+85°C$, $C_L = 50$ pF		Units
			Min	Typ	Max	Min	Max	
t_{PLH}	Propagation Delay S to Z_n	5.0	2.0	5.5	9.0	1.5	10.0	ns
t_{PHL}	Propagation Delay S to Z_n	5.0	2.0	5.5	9.5	2.0	10.5	ns
t_{PLH}	Propagation Delay $\overline{E}$ to Z_n	5.0	1.5	6.0	10.0	1.5	11.5	ns
t_{PHL}	Propagation Delay $\overline{E}$ to Z_n	5.0	1.5	5.0	8.5	1.0	9.0	ns
t_{PLH}	Propagation Delay I_n to Z_n	5.0	1.5	4.0	7.0	1.0	8.5	ns
t_{PHL}	Propagation Delay I_n to Z_n	5.0	1.5	4.5	7.5	1.0	8.5	ns

Note 8: Voltage Range 5.0 is 5.0V ± 0.5V

Capacitance

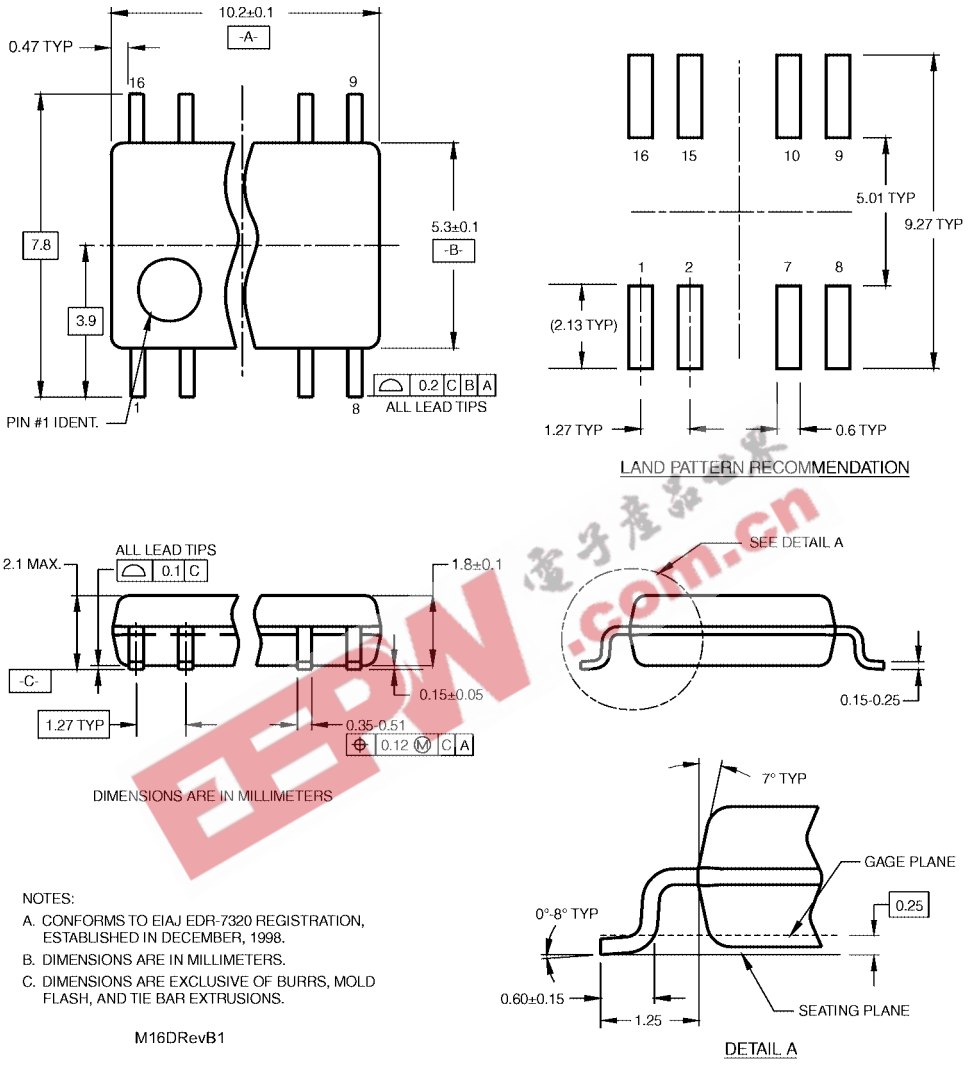
Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	4.5	pF	V_{CC} = OPEN
C_{PD}	Power Dissipation Capacitance	50.0	pF	V_{CC} = 5.0V

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)



NOTES:

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

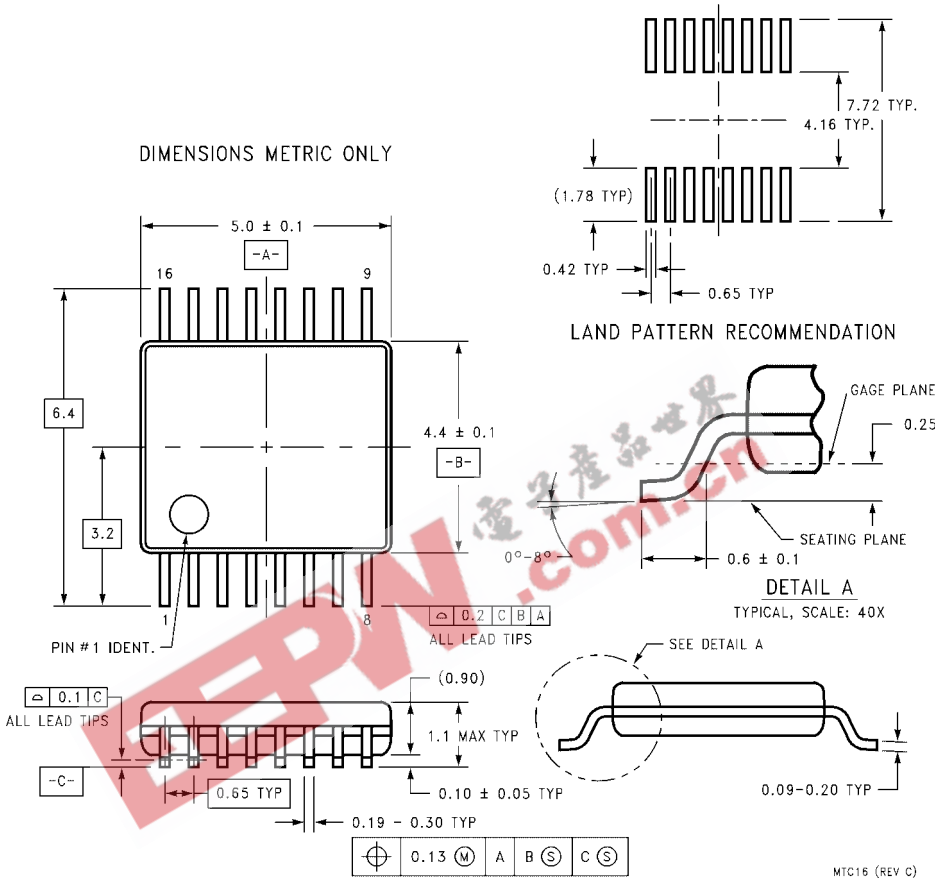
B. DIMENSIONS ARE IN MILLIMETERS.

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

M16DRevB1

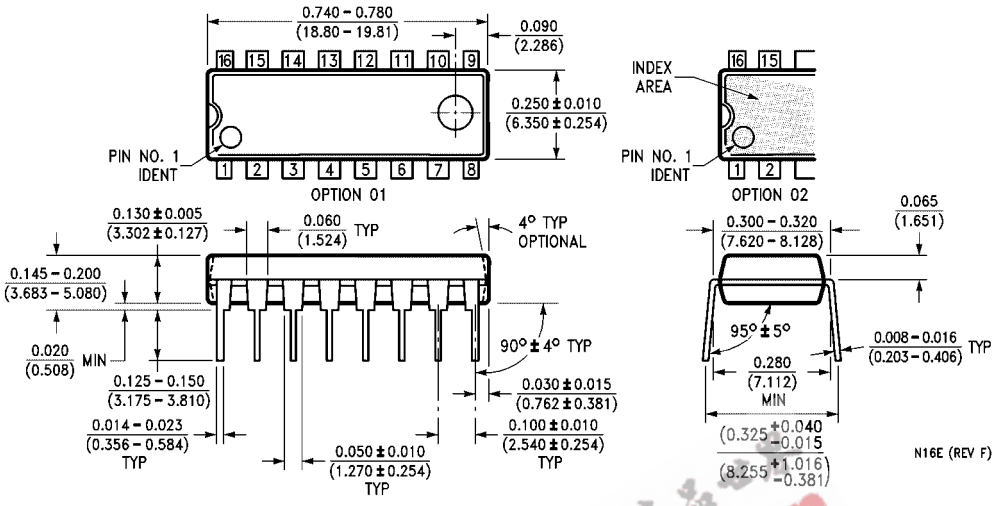
16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D

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

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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