



Is Now Part of



ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at
www.onsemi.com

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

74VHCT138A

3-to-8 Decoder/Demultiplexer

Features

- High Speed: $t_{PD} = 7.6ns$ (Typ.) at $V_{CC} = 5V$
- Low power dissipation: $I_{CC} = 4\mu A$ (Max.) at $T_A = 25^\circ C$
- Power down protection is provided on all inputs and outputs
- Pin and function compatible with 74HCT138

General Description

The VHCT138A is an advanced high speed CMOS 3-to-8 DECODER fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

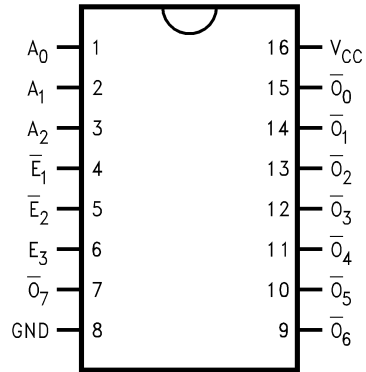
When the device is enabled, 3 Binary Select inputs (A_0 , A_1 and A_2) determine which one of the outputs (O_0 – O_7) will go LOW. When enable input E_3 is held LOW or either \bar{E}_1 or \bar{E}_2 is held HIGH, decoding function is inhibited and all outputs go HIGH. E_3 , \bar{E}_1 and \bar{E}_2 inputs are provided to ease cascade connection and for use as an address decoder for memory systems. Protection circuits ensure that 0V to 7V can be applied to the input pins without regard to the supply voltage and to the output pins with $V_{CC} = 0V$. These circuits prevent device destruction due to mismatched supply and input/output voltages. This device can be used to interface 3V to 5V systems and two supply systems such as battery backup.

Ordering Information

Order Number	Package Number	Package Description
74VHCT138AM	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VHCT138ASJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74VHCT138AMTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering number.

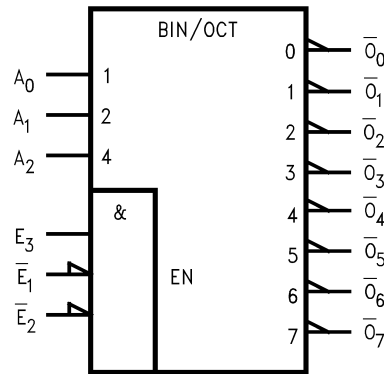
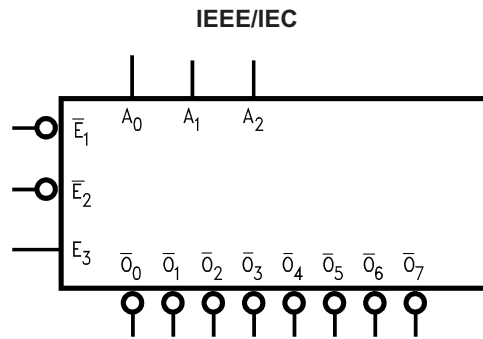
Connection Diagram



Pin Description

Pin Names	Description
A_0 – A_2	Address Inputs
\bar{E}_1 – \bar{E}_2	Enable Inputs
E_3	Enable Input
\bar{O}_0 – \bar{O}_7	Outputs

Logic Symbols

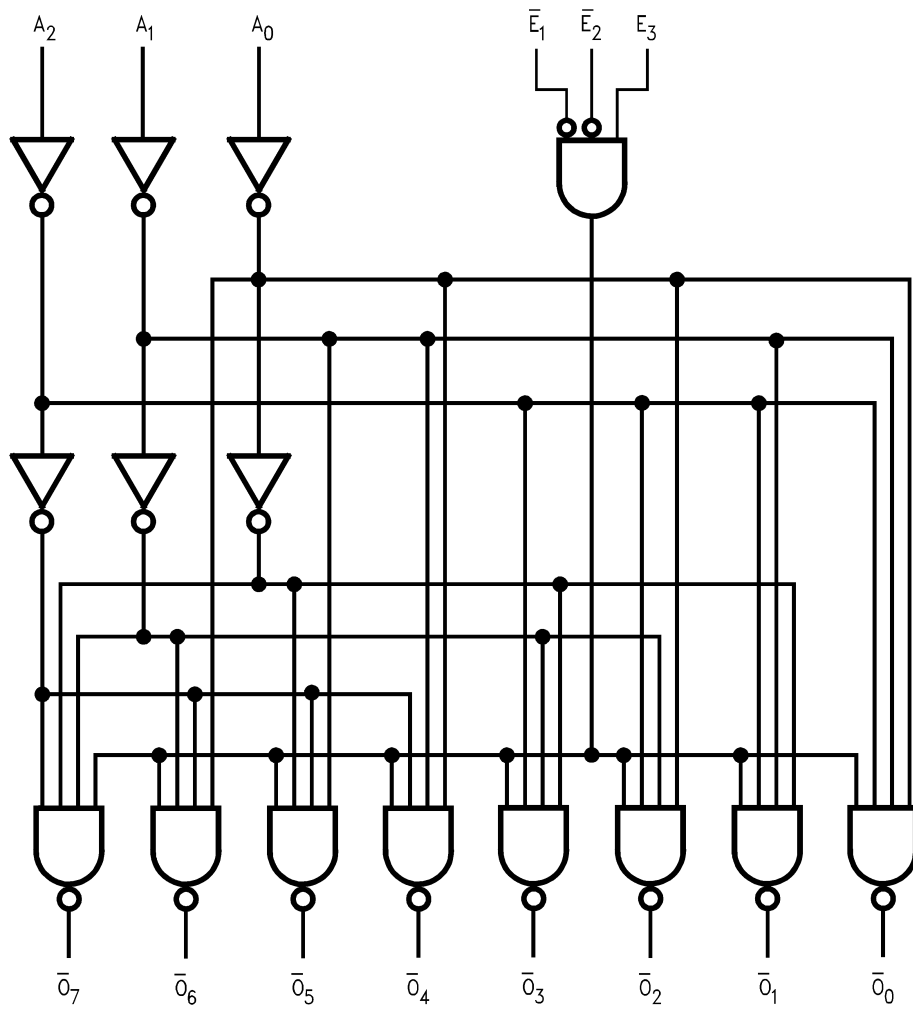


Truth Table

Inputs						Outputs							
\bar{E}_1	\bar{E}_2	E_3	A_0	A_1	A_2	\bar{O}_0	\bar{O}_1	\bar{O}_2	\bar{O}_3	\bar{O}_4	\bar{O}_5	\bar{O}_6	\bar{O}_7
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	L	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	H	L	L	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	H	H	L	H	H	H	H
L	L	H	L	L	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	L	H	H
L	L	H	L	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	L

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

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
V_{IN}	DC Input Voltage	-0.5V to +7.0V
V_{OUT}	DC Output Voltage Note 1 Note 2	-0.5V to 7.0V -0.5V to $V_{CC} + 0.5V$
I_{IK}	Input Diode Current	-20mA
I_{OK}	Output Diode Current ⁽³⁾	±20mA
I_{OUT}	DC Output Current	±25mA
I_{CC}	DC V_{CC} /GND Current	±75mA
T_{STG}	Storage Temperature	-65°C to +150°C
T_L	Lead Temperature (Soldering, 10 seconds)	260°C

Recommended Operating Conditions⁽⁴⁾

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	4.5V to +5.5V
V_{IN}	Input Voltage	0V to +5.5V
V_{OUT}	Output Voltage Note 1 Note 2	0V to 5.5V 0V to V_{CC}
T_{OPR}	Operating Temperature	-40°C to +85°C
t_r, t_f	Input Rise and Fall Time, $V_{CC} = 5.0V \pm 0.5V$	0 ~ 20ns/V

Notes:

- $V_{CC} = 0V$.
- HIGH or LOW state. I_{OUT} absolute maximum rating must be observed.
- $V_{OUT} < GND$, $V_{OUT} > V_{CC}$ (Outputs Active).
- Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	V _{CC} (V)	Conditions	T _A = 25°C			T _A = -40°C to +85°C		Units	
				Min.	Typ.	Max.	Min.	Max.		
V _{IH}	HIGH Level Input Voltage	4.5 – 5.5		2.0			2.0		V	
V _{IL}	LOW Level Input Voltage	4.5 – 5.5				0.8		0.8	V	
V _{OH}	HIGH Level Output Voltage	4.5	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50μA	4.4	4.5		4.4		V
				I _{OH} = -8mA	3.94			3.80		
V _{OL}	LOW Level Output Voltage	4.5	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50μA		0.0	0.1		0.1	V
				I _{OL} = 8mA			0.36		0.44	
I _{IN}	Input Leakage Current	0 – 5.5	V _{IN} = 5.5V or GND				±0.1		±1.0	μA
I _{CC}	Quiescent Supply Current	5.5	V _{IN} = V _{CC} or GND				4.0		20.0	μA
I _{CCT}	Maximum I _{CC} /Input	5.5	V _{IN} = 3.4V, All other inputs = V _{CC} or GND				1.35		1.50	mA
I _{OFF}	Output Leakage Current	0	V _{OUT} = 5.5V				0.5		5.0	μA

AC Electrical Characteristics

Symbol	Parameter	V _{CC} (V)	Conditions	T _A = 25°C			T _A = -40°C to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
t _{PLH} , t _{PHL}	Propagation Delay, A _n to O _n	5.0 ± 0.5	C _L = 15pF		7.6	10.4	1.0	12.0	ns
			C _L = 50pF		8.1	11.4	1.0	13.0	
t _{PLH} , t _{PHL}	Propagation Delay, E ₃ to O _n	5.0 ± 0.5	C _L = 15pF		6.6	9.1	1.0	10.5	ns
			C _L = 50pF		7.1	10.1	1.0	11.5	
t _{PLH} , t _{PHL}	Propagation Delay, E ₁ or E ₂ to O _n	5.0 ± 0.5	C _L = 15pF		7.0	9.6	1.0	11.0	ns
			C _L = 50pF		7.5	10.6	1.0	12.0	
C _{IN}	Input Capacitance		V _{CC} = Open		4	10		10	pF
C _{PD}	Power Dissipation Capacitance		⁽⁵⁾		49				pF

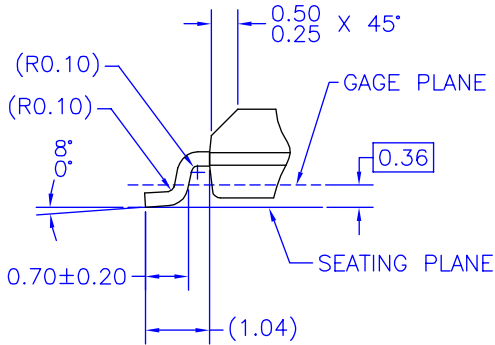
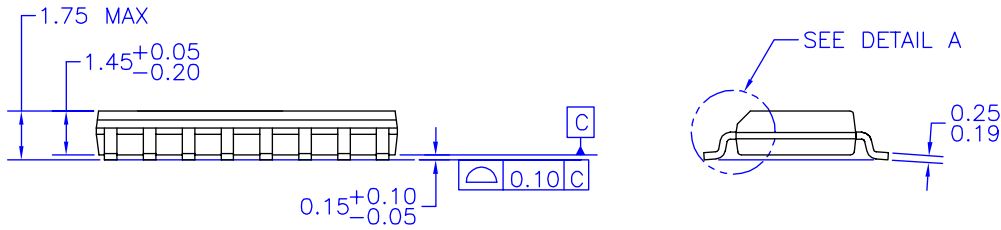
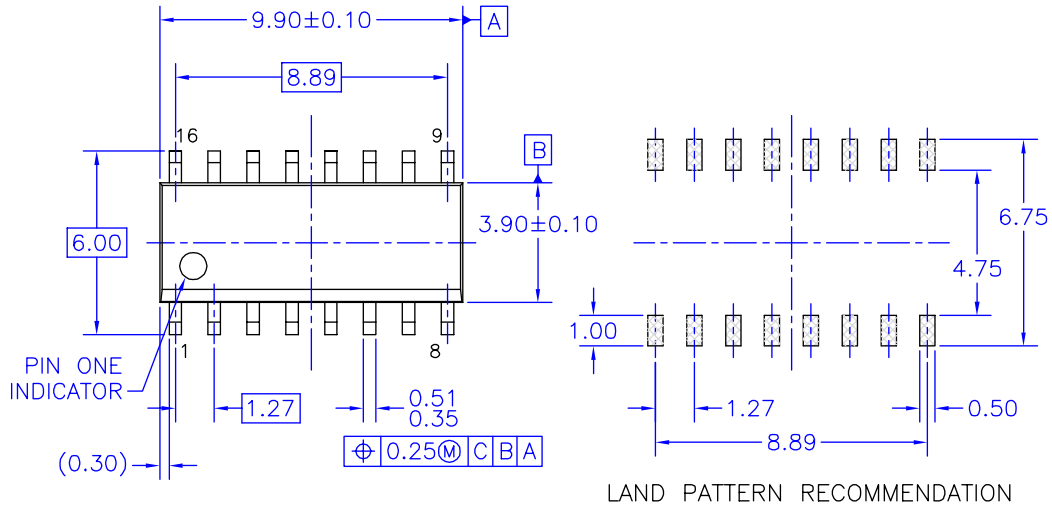
Note:

5. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:

$$I_{CC} (\text{Opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

Physical Dimensions

Dimensions are in millimeters unless otherwise noted.



DETAIL A
SCALE: 2:1

NOTES: UNLESS OTHERWISE SPECIFIED

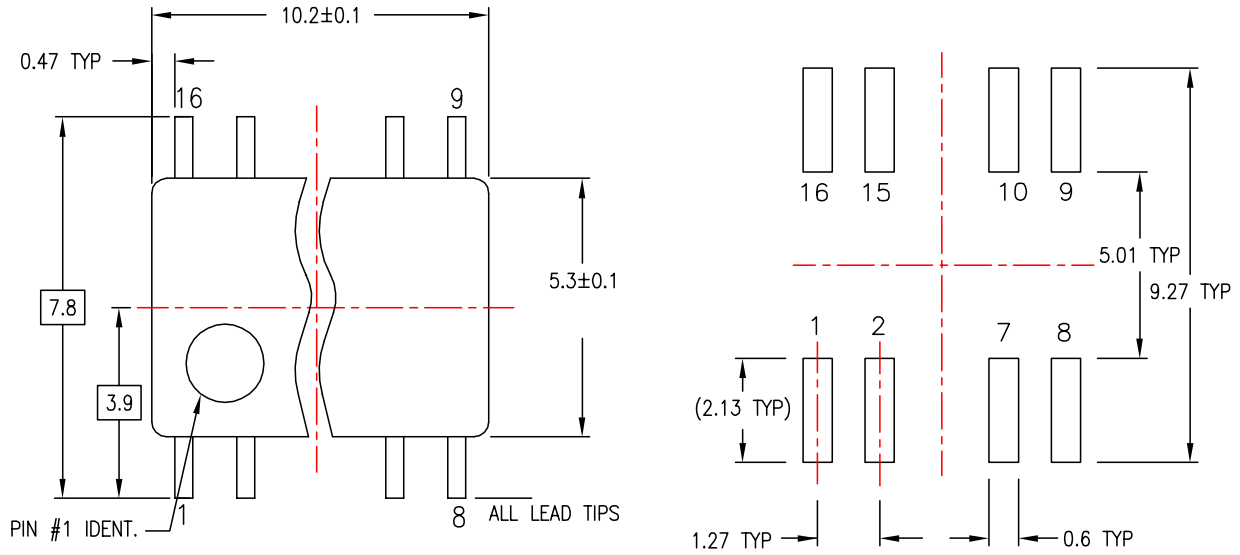
- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AC, ISSUE C, DATED MAY 1990.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) STANDARD LEAD FINISH:
200 MICRONS / 5.08 MICRONS MIN.
LEAD/TIN (SOLDER) ON COPPER.

M16AREVK

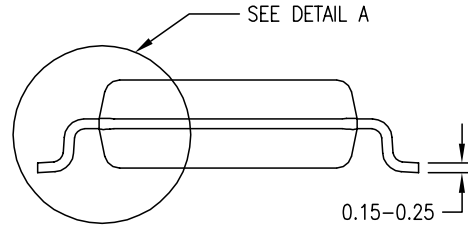
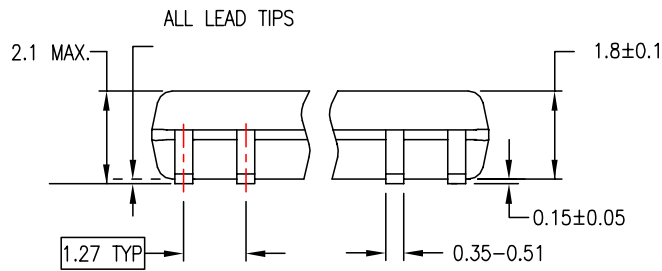
Figure 1. 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Package Number M16A

Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.



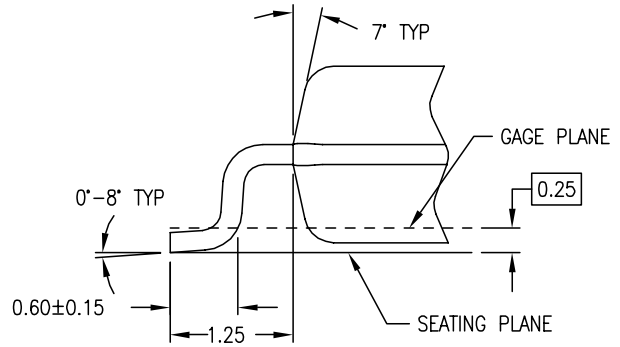
LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS

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.



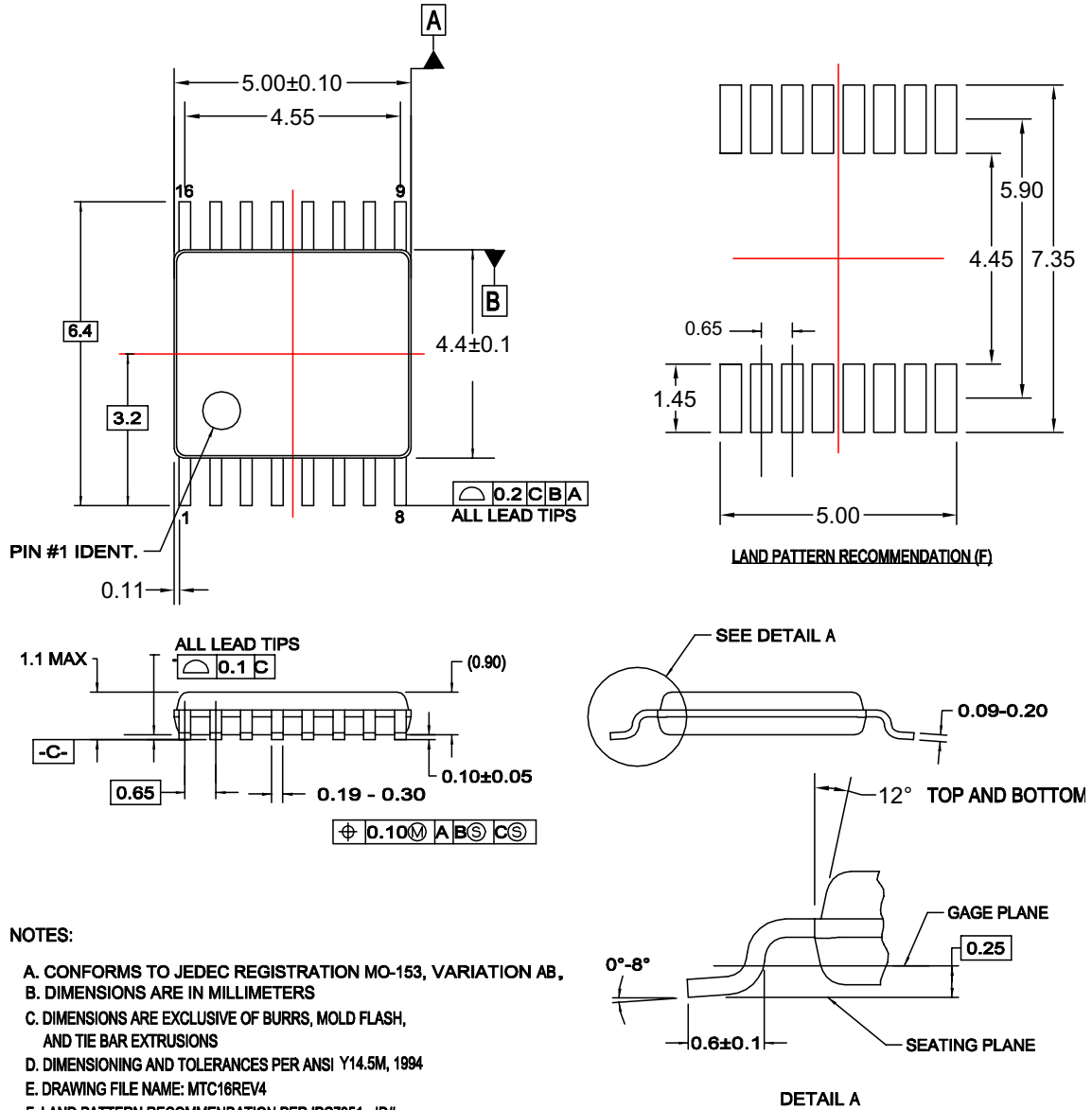
DETAIL A

M16DREVC

Figure 2. 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 3. 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC16



TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACEx [®]	HiSeC [™]	Power-SPM [™]	TinyBuck [™]
Across the board. Around the world. [™]	<i>i-Lo</i> [™]	PowerTrench [®]	TinyLogic [®]
ActiveArray [™]	ImpliedDisconnect [™]	Programmable Active Droop [™]	TINYOPTO [™]
Bottomless [™]	IntelliMAX [™]	QFET [®]	TinyPower [™]
Build it Now [™]	ISOPLANAR [™]	QS [™]	TinyWire [™]
CoolFET [™]	MICROCOUPLER [™]	QT Optoelectronics [™]	TruTranslation [™]
CorePLUS [™]	MicroPak [™]	Quiet Series [™]	μSerDes [™]
CROSSVOLT [™]	MICROWIRE [™]	RapidConfigure [™]	UHC [®]
CTL [™]	Motion-SPM [™]	RapidConnect [™]	UniFET [™]
Current Transfer Logic [™]	MSX [™]	ScalarPump [™]	VCX [™]
DOME [™]	MSXPro [™]	SMART START [™]	Wire [™]
E ² C MOS [™]	OCX [™]	SPM [®]	
EcoSPARK [®]	OCXPro [™]	STEALTH [™]	
EnSigna [™]	OPTOLOGIC [®]	SuperFET [™]	
FACT Quiet Series [™]	OPTOPLANAR [®]	SuperSOT [™] -3	
FACT [®]	PACMAN [™]	SuperSOT [™] -6	
FAST [®]	PDP-SPM [™]	SuperSOT [™] -8	
FASTr [™]	POP [™]	SyncFET [™]	
FPS [™]	Power220 [®]	TCM [™]	
FRFET [®]	Power247 [®]	The Power Franchise [®]	
GlobalOptoisolator [™]	PowerEdge [™]	 ™	
GTO [™]	PowerSaver [™]	TinyBoost [™]	

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
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.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.

Rev. I27

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com
Order Literature: <http://www.onsemi.com/orderlit>
For additional information, please contact your local
Sales Representative