

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 <a href="general-regarding-numbers-n

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 EDA 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 officer



October 1996 Revised June 2005

74VCX16245

Low Voltage 16-Bit Bidirectional Transceiver with 3.6V Tolerant Inputs and Outputs

General Description

The VCX16245 contains sixteen non-inverting bidirectional buffers with 3-STATE outputs and is intended for bus oriented applications. The device is byte controlled. Each byte has separate 3-STATE control inputs which can be shorted together for full 16-bit operation. The T/\overline{R} inputs determine the direction of data flow through the device. The \overline{OE} inputs disable both the A and B ports by placing them in a high impedance state.

The 74VCX16245 is designed for low voltage (1.2V to 3.6V) V_{CC} applications with I/O compatibility up to 3.6V.

The 74VCX16245 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining low CMOS power dissipation.

Features

- 1.2V to 3.6V V_{CC} supply operation
- 3.6V tolerant inputs and outputs
- ton

2.5 ns max for 3.0V to 3.6V $\rm V_{\rm CC}$

- Power-off high impedance inputs and outputs
- Supports live insertion/withdrawal (Note 1)
- Static Drive (I_{OH}/I_{OL})

±24 mA @ 3.0V V_{CC}

- Uses proprietary noise/EMI reduction circuitry
- Latchup performance exceeds 300 mA
- ESD performance:

Human body model > 2000V

Machine model >200V

Also packaged in plastic Fine-Pitch Ball Grid Array (FBGA)

Note 1: To ensure the high-impedance state during power up or power down, OE should be tied to V_{CC} through a pull-up resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver

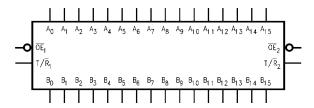
Ordering Code:

Order Number	Package Number	Package Description
74VCX16245G (Note 2)(Note 3)	BGA54A	54-Ball Fine-Pitch Ball Grid Array (FBGA), JEDEC MO-205, 5.5mm Wide
74VCX16245MTD (Note 3)	MTD48	48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

Note 2: Ordering code "G" indicates Trays.

Note 3: Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Logic Symbol

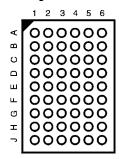


Connection Diagrams

Pin Assignment of TSSOP



Pin Assignment for FBGA



(Top Thru View)

Pin Descriptions

Pin Names Description	
OE _n	Output Enable Input (Active LOW)
T/R _n	Transmit/Receive Input
A ₀ -A ₁₅ B ₀ -B ₁₅	Side A Inputs or 3-STATE Outputs
B ₀ -B ₁₅	Side B Inputs or 3-STATE Outputs
NC	No Connect

FBGA Pin Assignments

	1	2	3	4	5	6
Α	B ₀	NC	T/R ₁	OE ₁	NC	A ₀
В	B ₂	B ₁	NC	NC	A ₁	A ₂
С	B ₄	B ₃	V _{CC}	V _{CC}	A ₃	A ₄
D	B ₆	B ₅	GND	GND	A ₅	A ₆
E	B ₈	B ₇	GND	GND	A ₇	A ₈
F	B ₁₀	B ₉	GND	GND	A ₉	A ₁₀
G	B ₁₂	B ₁₁	V _{CC}	V _{CC}	A ₁₁	A ₁₂
Н	B ₁₄	B ₁₃	NC	NC	A ₁₃	A ₁₄
J	B ₁₅	NC	T/R ₂	OE ₂	NC	A ₁₅

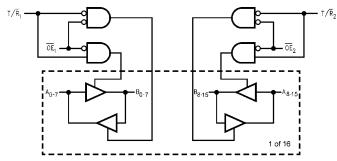
Truth Tables

lnı	outs	Outrot
OE ₁	T/R ₁	Outputs
L	L	Bus B ₀ -B ₇ Data to Bus A ₀ -A ₇
L	Н	Bus A ₀ –A ₇ Data to Bus B ₀ –B ₇
Н	X	HIGH Z State on A ₀ –A ₇ , B ₀ –B ₇

Inputs		0.1.1.
OE ₂	T/R ₂	Outputs
L	L	Bus B ₈ –B ₁₅ Data to Bus A ₈ –A ₁₅
L	Н	Bus A ₈ -A ₁₅ Data to Bus B ₈ -B ₁₅
Н	X	HIGH Z State on A ₈ -A ₁₅ , B ₈ -B ₁₅

- H = HIGH Voltage Level
- $\label{eq:Lambda} L = LOW\ Voltage\ Level \\ X = Immaterial\ (HIGH\ or\ LOW,\ inputs\ and\ I/O's\ may\ not\ float) \\ Z = High\ Impedance$

Logic Diagram



Absolute Maximum Ratings(Note 4)

-0.5V to +4.6V Supply Voltage (V_{CC}) DC Input Voltage (V_I) -0.5V to +4.6V Output Voltage (V_O) Outputs 3-STATE -0.5V to +4.6VOutputs Active (Note 5) -0.5 to $V_{CC} + 0.5V$ DC Input Diode Current (I_{IK}) $V_I < 0V$ -50 mA DC Output Diode Current (I_{OK}) $V_{O} < 0V$ -50 mA $V_{O} > V_{CC}$ +50 mA DC Output Source/Sink Current (I_{OH}/I_{OL}) $\pm 50 \text{ mA}$ DC V_{CC} or Ground Current per Supply Pin (I_{CC} or Ground) ±100 mA Storage Temperature Range (T_{STG}) -65°C to +150°C

Recommended Operating Conditions (Note 6)

Power Supply	
Operating	1.2V to 3.6V
Input Voltage	-0.3V to 3.6V
Output Voltage (V _O)	
Output in Active States	$\rm 0V$ to $\rm V_{CC}$
Output in 3-STATE	0.0V to 3.6V
Output Current in I _{OH} /I _{OL}	
$V_{CC} = 3.0V \text{ to } 3.6V$	±24 mA
$V_{CC} = 2.3V \text{ to } 2.7V$	±18 mA
$V_{CC} = 1.65V \text{ to } 2.3V$	±6 mA
$V_{CC} = 1.4V \text{ to } 1.6V$	±2 mA
V _{CC} = 1.2V	±100 μA
Free Air Operating Temperature (T _A)	-40°C to +85°C
Minimum Input Edge Rate (Δt/ΔV)	

Note 4: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the Absolute Maximum Ratings. The Recommended Operating Conditions tables will define the conditions for actual device operation.

Note 5: IO Absolute Maximum Rating must be observed.

 $V_{IN} = 0.8V$ to 2.0V, $V_{CC} = 3.0V$

Note 6: Floating or unused pin (inputs or I/O's) must be held HIGH or LOW.

DC Electrical Characteristics

Symbol	Parameter	Conditions	V _{CC} (V)	Min	Max	Units
V _{IH}	HIGH Level Input Voltage		2.7 - 3.6	2.0		
*IH	Thorr Level input voltage		2.3 - 2.7	1.6		
			1.65 - 2.3	0.65 x V _{CC}		V
			1.4 - 1.6	0.65 x V _{CC}		•
			1.2	0.65 x V _{CC}		
V _{IL}	LOW Level Input Voltage		2.7 - 3.6		0.8	
IL.	, , , , , , , ,		2.3 - 2.7		0.7	
			1.65 - 2.3		0.35 x V _{CC}	V
			1.4 - 1.6		0.35 x V _{CC}	
			1.2		0.05 x V _{CC}	
V _{OH}	HIGH Level Output Voltage	I _{OH} = -100 μA	2.7 - 3.6	V _{CC} - 0.2		
		I _{OH} = -12 mA	2.7	2.2		
		I _{OH} = -18 mA	3.0	2.4		
		$I_{OH} = -24 \text{ mA}$	3.0	2.2		
		$I_{OH} = -100 \mu A$	2.3 - 2.7	V _{CC} - 0.2		•
		$I_{OH} = -6 \text{ mA}$	2.3	2.0		
		$I_{OH} = -12 \text{ mA}$	2.3	1.8		V
		$I_{OH} = -18 \text{ mA}$	2.3	1.7		
		$I_{OH} = -100 \mu A$	1.65 - 2.3	V _{CC} - 0.2		•
		$I_{OH} = -6 \text{ mA}$	1.65	1.25		
		$I_{OH} = -100 \mu A$	1.4 - 1.6	V _{CC} - 0.2		•
		I _{OH} = -2 mA	1.4	1.05		
		$I_{OH} = -100 \mu A$	1.2	V _{CC} - 0.2		•

DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	V _{CC} (V)	Min	Max	Units
V _{OL}	LOW Level Output Voltage	I _{OL} = 100 μA	2.7 - 3.6		0.2	
		I _{OL} = 12 mA	2.7		0.4	
		I _{OL} = 18 mA	3.0		0.4	
		I _{OL} = 24 mA	3.0		0.55	
		$I_{OL} = 100 \mu A$	2.3 - 2.7		0.2	
		I _{OL} = 12 mA	2.3		0.4	V
		I _{OL} = 18 mA	2.3		0.6	V
		$I_{OL} = 100 \mu A$	1.65 - 2.3		0.2	
		I _{OL} = 6 mA	1.65		0.3	
		$I_{OL} = 100 \mu A$	1.4 - 1.6		0.2	
		I _{OL} = 2 mA	1.4		0.35	
		I _{OL} = 100 μA	1.2		V _{CC} - 0.1	
l _l	Input Leakage Current	$0V \le V_I \le 3.6V$	1.2 - 3.6		±5.0	μΑ
loz	3-STATE Output Leakage	$0V \le V_O \le 3.6V$	1.2 - 3.6		±10	μА
		$V_I = V_{IH}$ or V_{IL}	1.2 - 3.0		±10	μΛ
l _{OFF}	Power Off Leakage Current	$0V \leq (V_I, V_O) \leq 3.6V$	0		10	μΑ
Icc	Quiescent Supply Current	V _I = V _{CC} or GND	1.2 - 3.6		20	μА
		$V_{CC} \le (V_I, V_O) \le 3.6V \text{ (Note 7)}$	1.2 - 3.6		±20	μΛ
ΔI_{CC}	Increase in I _{CC} per Input	V _{IH} = V _{CC} - 0.6V	2.7 - 3.6		750	μА

Note 7: Outputs disabled or 3-STATE only.

AC Electrical Characteristics (Note 8)

Symbol	Parameter	Conditions	V _{CC}	T _A = -40°	C to +85°C	Units	Figure
Symbol	raiailletei	Conditions	(V)	Min	Max	Units	Number
t _{PHL}	Propagation Delay	$C_L = 30 \text{ pF}, R_L = 500\Omega$	3.3 ± 0.3	0.8	2.5		1
t _{PLH}			2.5 ± 0.2	1.0	3.0		Figures 1, 2
			1.8 ± 0.15	1.0	6.0	ns	.,_
		$C_L = 15 \text{ pF}, R_L = 2k\Omega$	1.5 ± 0.1	1.0	12.0		Figures
			1.2	1.5	30		5, 6
t _{PZL}	Output Enable Time	$C_L = 30 \text{ pF}, R_L = 500\Omega$	3.3 ± 0.3	0.8	3.8		Ī
t _{PZH}			2.5 ± 0.2	1.0	4.9		Figures 1, 3, 4
			1.8 ± 0.15	1.5	9.3	ns	., -, -
		$C_L = 15 \text{ pF}, R_L = 2k\Omega$	1.5 ± 0.1	1.0	18.6		Figures
			1.2	1.5	46.5		5, 7, 8
t _{PLZ}	Output Disable Time	$C_L = 30 \text{ pF}, R_L = 500\Omega$	3.3 ± 0.3	0.8	3.7		
t _{PHZ}			2.5 ± 0.2	1.0	4.2		Figures 1, 3, 4
			1.8 ± 0.15	1.5	7.6	ns	, -,
		$C_L = 15 \text{ pF}, R_L = 2k\Omega$	1.5 ± 0.1	1.0	15.2		Figures
			1.2	1.5	38		5, 7, 8
t _{OSHL}	Output to Output	$C_L = 30 \text{ pF}, R_L = 500\Omega$	3.3 ± 0.3		0.5		
t _{OSLH}	Skew (Note 9)		2.5 ± 0.2		0.5		
			1.8 ± 0.15		0.75	ns	
		$C_L = 15 \text{ pF}, R_L = 2k\Omega$	1.5 ± 0.1		1.5		
			1.2		1.5		

Note 8: For $C_L = 50 pF$, add approximately 300ps to the AC maximum specification.

Note 9: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t_{OSHL}) or LOW-to-HIGH (t_{OSLH}).

Dyna	Dynamic Switching Characteristics					
Symbol	Parameter	Conditions	V _{CC}	T _A = +25°C	Units	
•			(V)	Typical		
V _{OLP}	Quiet Output Dynamic Peak V _{OL}	$C_L = 30 \text{ pF}, V_{IH} = V_{CC}, V_{IL} = 0V$	1.8	0.25		
			2.5	0.6	V	
			3.3	0.8		
V _{OLV}	Quiet Output Dynamic Valley V _{OL}	$C_L = 30 \text{ pF}, V_{IH} = V_{CC}, V_{IL} = 0V$	1.8	-0.25		
			2.5	-0.6	V	
			3.3	-0.8		
V _{OHV}	Quiet Output Dynamic Valley V _{OH}	$C_L = 30 \text{ pF}, V_{IH} = V_{CC}, V_{IL} = 0V$	1.8	1.5		
			2.5	1.9	V	
			3.3	2.2		

Capacitance

Symbol Parameter		Conditions	$T_A = +25^{\circ}C$	Units
Cymbol	i diametei	Oditutions	Typical	Oille
C _{IN}	Input Capacitance	$V_{CC} = 1.8V, 2.5V, \text{ or } 3.3V, V_I = 0V \text{ or } V_{CC}$	6	pF
C _{I/O}	Output Capacitance	V _I = 0V, or V _{CC} , V _{CC} = 1.8V, 2.5V or 3.3V	7	pF
C _{PD}	Power Dissipation Capacitance	$V_{I} = 0V \text{ or } V_{CC}, F = 10 \text{ MHz}, V_{CC} = 1.8V, 2.5V \text{ or } 3.3V$	20	pF

AC Loading and Waveforms (V $_{CC}$ 3.3V \pm 0.3V to 1.8V \pm 0.15V)

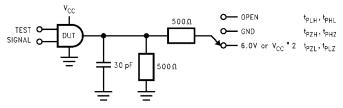


FIGURE 1. AC Test Circuit

TEST	SWITCH
t _{PLH} , t _{PHL}	Open
t_{PZL} , t_{PLZ}	6V at $V_{CC} = 3.3 \pm 0.3V$;
	V_{CC} x 2 at V_{CC} = 2.5 ± 0.2V; 1.8V ± 0.15V
t _{PZH} , t _{PHZ}	GND

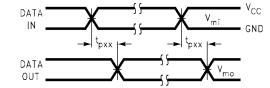


FIGURE 2. Waveform for Inverting and Non-inverting Functions

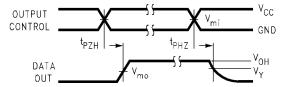


FIGURE 3. 3-STATE Output High Enable and Disable Times for Low Voltage Logic

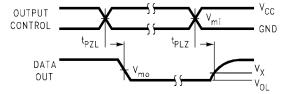
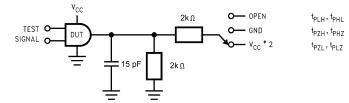


FIGURE 4. 3-STATE Output Low Enable and Disable Times for Low Voltage Logic

Symbol	V _{cc}		
	3.3V ± 0.3V	2.5V ± 0.2V	1.8V ± 0.15V
V _{mi}	1.5V	V _{CC} /2	V _{CC} /2
V _{mo}	1.5V	V _{CC} /2	V _{CC} /2
V _X	V _{OL} + 0.3V	V _{OL} + 0.15V	V _{OL} + 0.15V
V _Y	V _{OH} – 0.3V	V _{OH} – 0.15V	V _{OH} – 0.15V

AC Loading and Waveforms (V $_{CC}$ 1.5V \pm 0.1V to 1.2V)



TEST	SWITCH
t _{PLH} , t _{PHL}	Open
t_{PZL} , t_{PLZ}	V_{CC} x 2 at V_{CC} = 1.5 ± 0.1V

FIGURE 5. AC Test Circuit

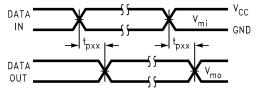


FIGURE 6. Waveform for Inverting and Non-Inverting Functions

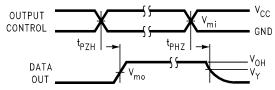


FIGURE 7. 3-STATE Output High Enable and Disable Times for Low Voltage Logic

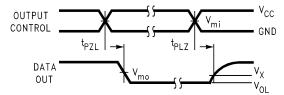
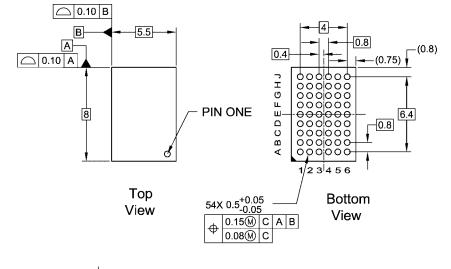
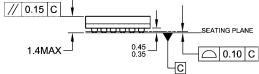


FIGURE 8. 3-STATE Output Low Enable and Disable Times for Low Voltage Logic

Symbol	V _{CC}	
Cymbol	1.5V ± 0.1V	
V _{mi}	V _{CC} /2	
V _{mo}	V _{CC} /2	
V _X	V _{OL} + 0.1V	
V_{Y}	V _{OH} – 0.1V	

Physical Dimensions inches (millimeters) unless otherwise noted



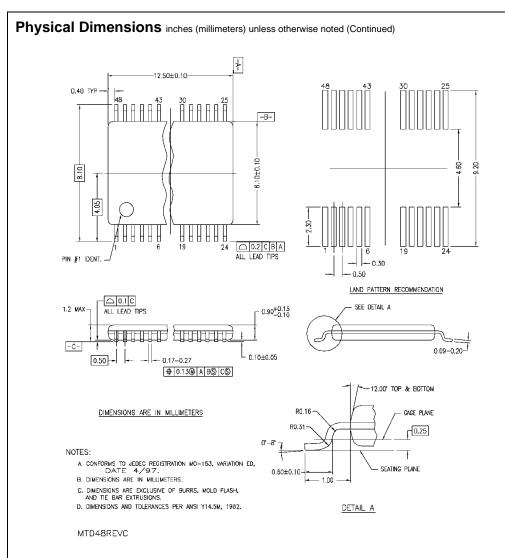


NOTES:

- A. THIS PACKAGE CONFORMS TO JEDEC M0-205
- **B. ALL DIMENSIONS IN MILLIMETERS**
- C. LAND PATTERN RECOMMENDATION: NSMD (Non Solder Mask Defined)
 .35MM DIA PADS WITH A SOLDERMASK OPENING OF .45MM CONCENTRIC TO PADS
 D. DRAWING CONFORMS TO ASME Y14.5M-1994

BGA54ArevD

54-Ball Fine-Pitch Ball Grid Array (FBGA), JEDEC MO-205, 5.5mm Wide Package Number BGA54A



48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide Package Number MTD48

Fairchild does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and Fairchild reserves the right at any time without notice to change said circuitry and specifications.

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 THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

- 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 to the user.
- 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.

www.fairchildsemi.com

ON Semiconductor and in 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/pdt/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. 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 exp

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

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

ON Semiconductor:

74VCX16245MTD 74VCX16245MTDX