



Is Now Part of



ON Semiconductor®

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

74VHC393

Dual 4-Bit Binary Counter

Features

- High Speed: $f_{MAX} = 170\text{MHz}$ (Typ.) at $T_A = 25^\circ\text{C}$
- Low power dissipation: $I_{CC} = 4\mu\text{A}$ (Max.) at $T_A = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (Min.)
- Power down protection is provided on all inputs
- Pin and function compatible with 74HC393

General Description

The VHC393 is an advanced high speed CMOS 4-bit Binary Counter 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. It contains two independent counter circuits in one package, so that counting or frequency division of 8 binary bits can be achieved with one IC. This device changes state on the negative going transition of the $\overline{\text{CLOCK}}$ pulse. The counter can be reset to "0" ($Q_0-Q_3 = \text{"L"}$) by a HIGH at the CLEAR input regardless of other inputs.

An input protection circuit ensures that 0V to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

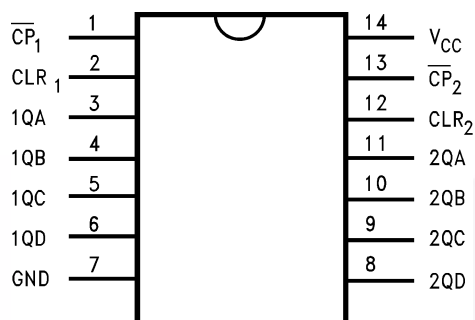
Ordering Information

Order Number	Package Number	Package Description
74VHC393M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VHC393SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74VHC393MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

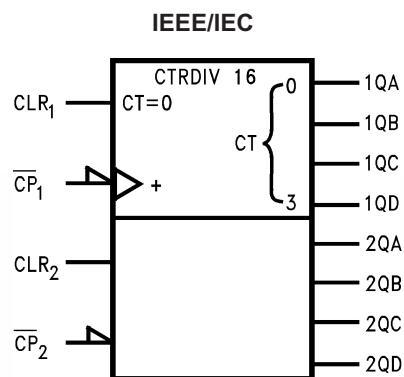
Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.

 All packages are lead free per JEDEC: J-STD-020B standard.

Connection Diagram



Logic Symbol/s



Pin Descriptions

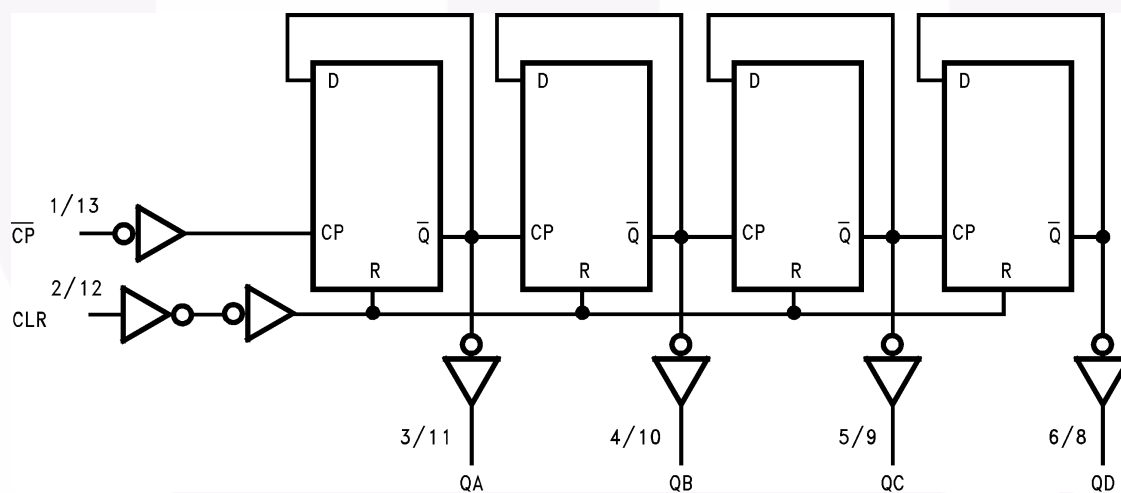
Pin Names	Description
CLR1, CLR2	Clear Inputs
$\overline{CP}_1, \overline{CP}_2$	Clock Pulse Inputs
QA, QB, QC, QD	Outputs

Truth Table

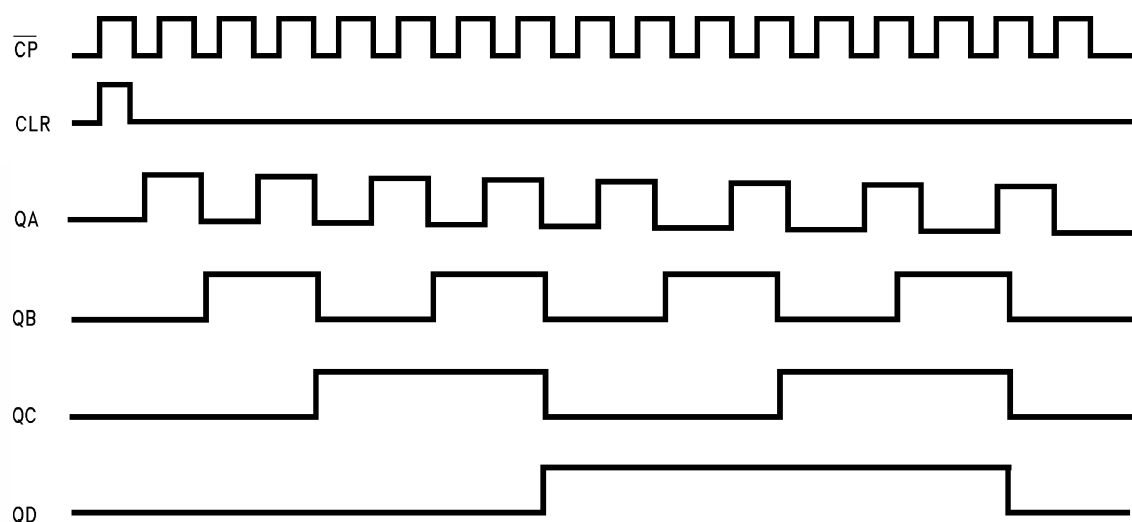
Inputs		Outputs			
$\overline{CP}$	CLR	QA	QB	QC	QD
X	H	L	L	L	L
$\overline{L}$	L	Count Up			
$\overline{H}$	L	No Change			

X: Don't Care

System Diagram



Timing Chart



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	−0.5V to $V_{CC} + 0.5V$
I_{IK}	Input Diode Current	−20mA
I_{OK}	Output Diode Current ⁽⁴⁾	±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⁽¹⁾

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	2.0V to +5.5V
V_{IN}	Input Voltage	0V to +5.5V
V_{OUT}	Output Voltage	0V to V_{CC}
T_{OPR}	Operating Temperature	−40°C to +85°C
t_r, t_f	Input Rise and Fall Time $V_{CC} = 3.3V \pm 0.3V$ $V_{CC} = 5.0V \pm 0.5V$	0 ~ 100ns/V 0 ~ 20ns/V

Note:

1. Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	Conditions	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		Units
				Min.	Typ.	Max.	Min.	Max.	
V_{IH}	HIGH Level Input Voltage	2.0		1.50			1.50		V
		3.0 – 5.5		$0.7 \times V_{CC}$			$0.7 \times V_{CC}$		
V_{IL}	LOW Level Input Voltage	2.0				0.50		0.50	V
		3.0 – 5.5				$0.3 \times V_{CC}$		$0.3 \times V_{CC}$	
V_{OH}	HIGH Level Output Voltage	2.0	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50\mu\text{A}$	1.9	2.0		1.9	V
		3.0			2.9	3.0		2.9	
		4.5			4.4	4.5		4.4	
		3.0	$I_{OH} = -4\text{mA}$	2.58			2.48		V
		4.5		$I_{OH} = -8\text{mA}$	3.94		3.80		
V_{OL}	LOW Level Output Voltage	2.0	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50\mu\text{A}$		0.0	0.1	0.1	V
		3.0				0.0	0.1	0.1	
		4.5				0.0	0.1	0.1	
		3.0	$I_{OL} = 4\text{mA}$			0.36		0.44	V
		4.5		$I_{OL} = 8\text{mA}$		0.36		0.44	
I_{IN}	Input Leakage Current	0 – 5.5	$V_{IN} = 5.5\text{V or GND}$				± 0.1	± 1.0	μA
I_{CC}	Quiescent Supply Current	5.5	$V_{IN} = V_{CC} \text{ or GND}$				4.0	40.0	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 Time (CP-QA)	3.3 ± 0.3	C _L = 15pF		8.6	13.2	1.0	15.5	ns
			C _L = 50pF		11.1	16.7	1.0	19.0	
		5.0 ± 0.5	C _L = 15pF		5.8	8.5	1.0	10.0	
			C _L = 50pF		7.3	10.5	1.0	12.0	
t _{PLH} , t _{PHL}	Propagation Delay Time (CP-QB)	3.3 ± 0.3	C _L = 15pF		10.2	15.8	1.0	18.5	ns
			C _L = 50pF		12.7	19.3	1.0	22.0	
		5.0 ± 0.5	C _L = 15pF		6.8	9.8	1.0	11.5	
			C _L = 50pF		8.3	11.8	1.0	13.5	
t _{PLH} , t _{PHL}	Propagation Delay Time (CP-QC)	3.3 ± 0.3	C _L = 15pF		11.7	18.0	1.0	21.0	ns
			C _L = 50pF		14.2	21.5	1.0	24.5	
		5.0 ± 0.5	C _L = 15pF		7.7	11.2	1.0	13.0	
			C _L = 50pF		9.2	13.2	1.0	15.0	
t _{PLH} , t _{PHL}	Propagation Delay Time (CP-QD)	3.3 ± 0.3	C _L = 15pF		13.0	19.7	1.0	23.0	ns
			C _L = 50pF		15.5	23.2	1.0	26.5	
		5.0 ± 0.5	C _L = 15pF		8.5	12.5	1.0	14.5	
			C _L = 50pF		10.0	14.5	1.0	16.5	
t _{PLH} , t _{PHL}	Propagation Delay Time (CLR-Q _n)	3.3 ± 0.3	C _L = 15pF		7.9	12.3	1.0	14.5	ns
			C _L = 50pF		10.4	15.8	1.0	18.0	
		5.0 ± 0.5	C _L = 15pF		5.4	8.1	1.0	9.5	
			C _L = 50pF		6.9	10.1	1.0	11.5	
f _{MAX}	Maximum Clock	3.3 ± 0.3	C _L = 15pF	75	120		65		MHz
			C _L = 50pF	45	65		35		
		5.0 ± 0.5	C _L = 15pF	125	170		105		
			C _L = 50pF	85	115		75		
C _{IN}	Input Capacitance		V _{CC} = Open		4	10		10	pF
C _{PD}	Power Dissipation Capacitance		(2)		23				pF

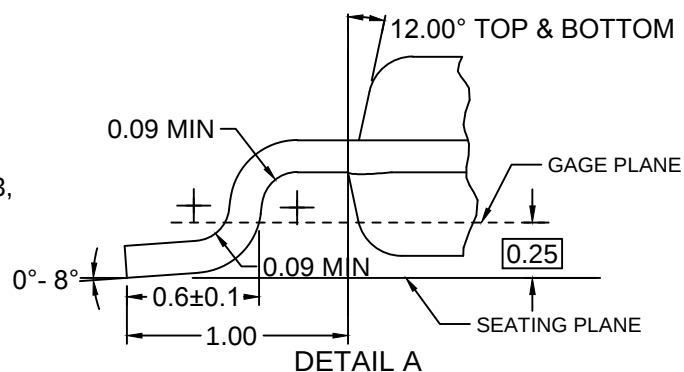
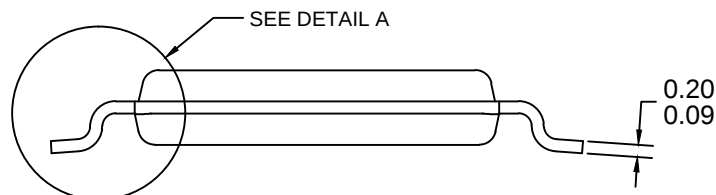
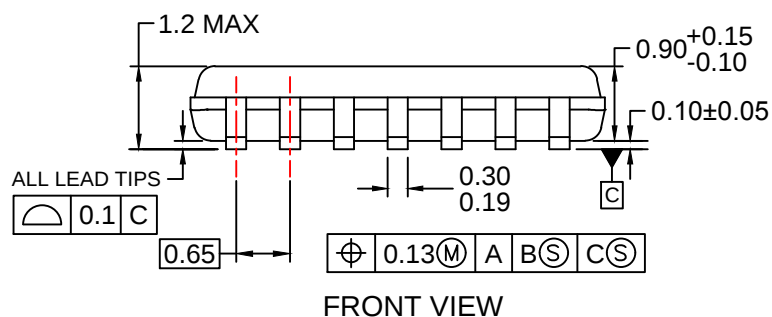
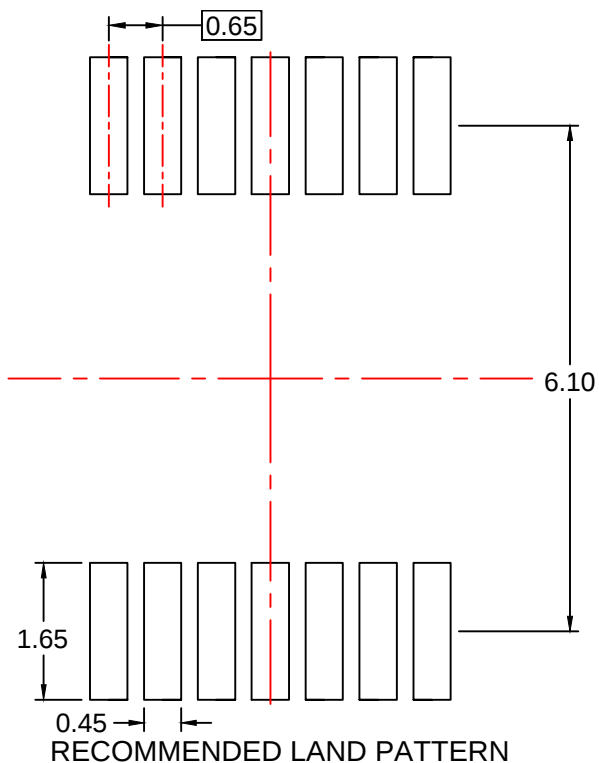
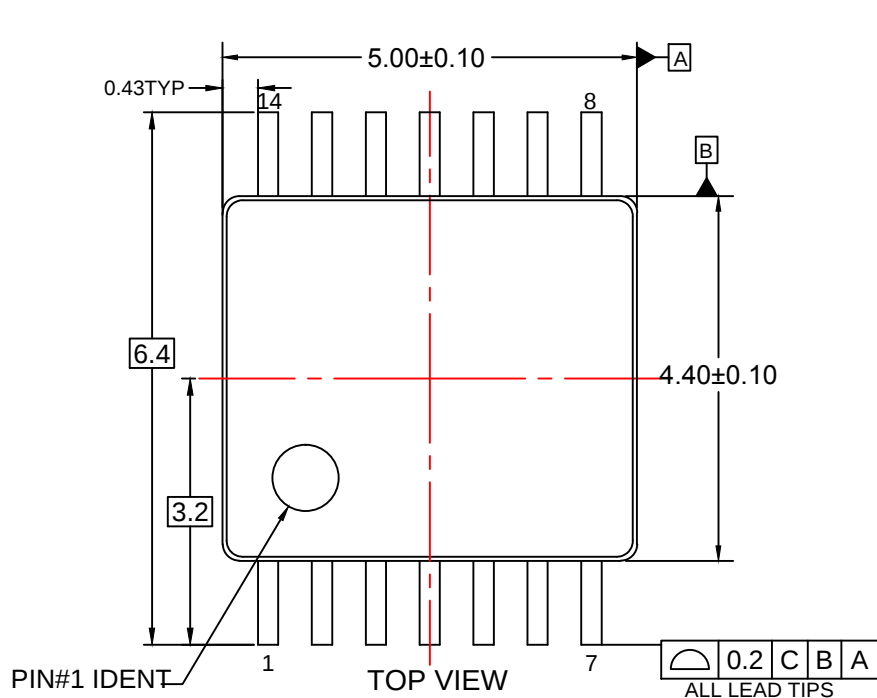
Note:

2. 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:

$$I_{CC(Oper.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 2 \text{ (per Counter)}$$

AC Operating Requirements

Symbol	Parameter	V _{CC} (V)	T _A = 25°C		T _A = − 40°C to +85°C	Units
			Typ.	Guaranteed Minimum		
t _W (L), t _W (H)	Minimum Pulse Width ($\overline{\text{CP}}$)	3.3 ± 0.3		5.0	5.0	ns
		5.0 ± 0.5		5.0	5.0	
t _W (H)	Minimum Pulse Width (CLR)	3.3 ± 0.3		5.0	5.0	ns
		5.0 ± 0.5		5.0	5.0	
t _{REM}	Minimum Removal Time	3.3 ± 0.3		5.0	5.0	ns
		5.0 ± 0.5		4.0	4.0	



NOTES:

- CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 2009.
- LANDPATTERN STANDARD: SOP65P640X110-14M.
- DRAWING FILE NAME: MKT-MTC14rev7.





NOTES:

- A. CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS
- D. LAND PATTERN STANDARD: SOIC127P600X145-14M
- E. CONFORMS TO ASME Y14.5M, 2009
- D. DRAWING FILENAME: MKT-M14Arev14



DETAIL A
SCALE 16 : 1



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