



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.

FIN1104 LVDS 4 Port High Speed Repeater

General Description

This 4 port repeater is designed for high speed interconnects utilizing Low Voltage Differential Signaling (LVDS) technology. The FIN1104 accepts and outputs LVDS levels with a typical differential output swing of 330 mV which provides low EMI at ultra low power dissipation even at high frequencies. The FIN1104 provides a V_{BB} reference for AC coupling on the inputs. In addition the FIN1104 can directly accept LVPECL, HSTL, and SSTL-2 for translation to LVDS.

Features

- Greater than 800 Mbps data rate
- 3.3V power supply operation
- 3.5 ps maximum random jitter and 135 ps maximum deterministic jitter
- Wide rail-to-rail common mode range
- LVDS receiver inputs accept LVPECL, HSTL, and SSTL-2 directly
- Ultra low power consumption
- 20 ps typical channel-to-channel skew
- Power off protection
- > 7.5 kV HBM ESD Protection
- Meets or exceeds the TIA/EIA-644-A LVDS standard
- Available in space saving 24-Lead TSSOP package
- Open circuit fail safe protection
- V_{BB} reference output

Ordering Code:

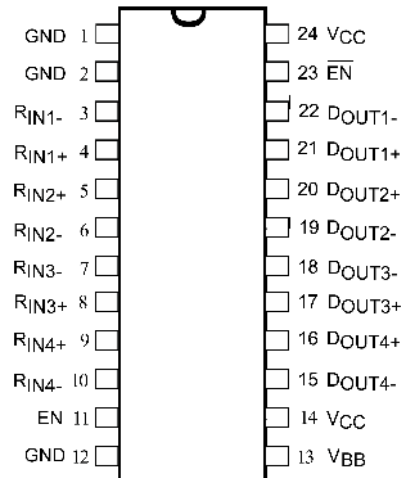
| Order Number | Package Number | Package Description |
|--------------|----------------|---|
| FIN1104MTC | MTC24 | 24-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

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

Pin Descriptions

| Pin Name | Description |
|--|---|
| R_{IN1+} , R_{IN2+} , R_{IN3+} , R_{IN4+} | Non-inverting LVDS Input |
| R_{IN1-} , R_{IN2-} , R_{IN3-} , R_{IN4-} | Inverting LVDS Input |
| D_{OUT1+} , D_{OUT2+} , D_{OUT3+} , D_{OUT4+} | Non-inverting Driver Output |
| D_{OUT1-} , D_{OUT2-} , D_{OUT3-} , D_{OUT4-} | Inverting Driver Output |
| EN | Driver Enable Pin for All Output |
| \overline{EN} | Inverting Driver Enable Pin for all Outputs |
| V_{CC} | Power Supply |
| GND | Ground |
| V_{BB} | Reference Voltage Output |

Connection Diagram

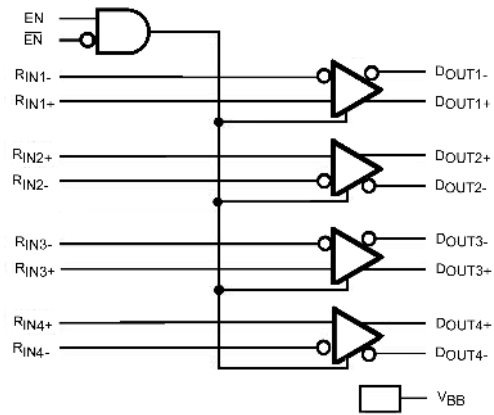


Function Table

| Inputs | | | | Outputs | |
|--------|------------------------|------------------|------------------|-------------------|-------------------|
| EN | $\overline{\text{EN}}$ | D _{IN+} | D _{IN-} | D _{OUT+} | D _{OUT-} |
| H | L | H | L | H | L |
| H | L | L | H | L | H |
| H | L | Fail Safe Case | | H | L |
| X | H | X | X | Z | Z |
| L | X | X | X | Z | Z |

H = HIGH Logic Level
 L = LOW Logic Level
 X = Don't Care
 Z = High Impedance

Functional Diagram



Absolute Maximum Ratings(Note 1)

| | |
|---|------------------|
| Supply Voltage (V_{CC}) | -0.5V to +4.6V |
| LVDS DC Input Voltage (V_{IN}) | -0.5V to +4.6V |
| LVDS DC Output Voltage (V_{OUT}) | -0.5V to +4.6V |
| Driver Short Circuit Current (I_{OSD}) | Continuous 10 mA |
| Storage Temperature Range (T_{STG}) | -65°C to +150°C |
| Max Junction Temperature (T_J) | 150°C |
| Lead Temperature (T_L) (Soldering, 10 seconds) | 260°C |
| ESD (Human Body Model) | 7500V |
| ESD (Machine Model) | 400V |

Recommended Operating Conditions

| | |
|--|---|
| Supply Voltage (V_{CC}) | 3.0V to 3.6V |
| Magnitude of Differential Voltage ($ V_{ID} $) | 100 mV to V_{CC} |
| Common Mode Voltage Range (V_{IC}) | (0V + $ V_{ID} /2$) to ($V_{CC} - V_{ID} /2$) |
| Operating Temperature (T_A) | -40°C to +85°C |

Note 1: The "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 circuits outside databook specification.

DC Electrical Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ (Note 2) | Max | Units |
|-----------------|--|---|-------------------|-----------------|-------------------------|---------|
| V_{TH} | Differential Input Threshold HIGH | See Figure 1; $V_{IC} = +0.05V, +1.2V, \text{ or } V_{CC} - 0.05V$ | | | 100 | mV |
| V_{TL} | Differential Input Threshold LOW | See Figure 1; $V_{IC} = +0.05V, +1.2V, \text{ or } V_{CC} - 0.05V$ | -100 | | | mV |
| V_{IH} | Input HIGH Voltage (\overline{EN} or \overline{EN}) | | 2.0 | | V_{CC} | V |
| V_{IL} | Input LOW Voltage (\overline{EN} or \overline{EN}) | | GND | | 0.8 | V |
| V_{OD} | Output Differential Voltage | | 250 | 330 | 450 | mV |
| ΔV_{OD} | V_{OD} Magnitude Change from Differential LOW-to-HIGH | $R_L = 100 \Omega$, Driver Enabled, See Figure 2 | | | 25 | mV |
| V_{OS} | Offset Voltage | | 1.125 | 1.23 | 1.375 | V |
| ΔV_{OS} | Offset Magnitude Change from Differential LOW-to-HIGH | | | | 25 | mV |
| I_{OS} | Short Circuit Output Current | $D_{OUT+} = 0V$ and $D_{OUT-} = 0V$, Driver Enabled | | -3.4 | -6 | mA |
| | | $V_{OD} = 0V$, Driver Enabled | | ± 3.4 | ± 6 | mA |
| I_{IN} | Input Current ($\overline{EN}, \overline{EN}, D_{INX+}, D_{INX-}$) | $V_{IN} = 0V$ to V_{CC} ; Other Input = V_{CC} or 0V (for Differential Inputs) | | | ± 20 | μA |
| I_{OFF} | Power Off Input or Output Current | $V_{CC} = 0V, V_{IN}$ or $V_{OUT} = 0V$ to 3.6V | | | ± 20 | μA |
| I_{CCZ} | Disabled Power Supply Current | Drivers Disabled | | 5.4 | 11 | mA |
| I_{CC} | Power Supply Current | Drivers Enabled, Any Valid Input Condition | | 30.4 | 41 | mA |
| I_{OZ} | Disabled Output Leakage Current | Driver Disabled, $D_{OUT+} = 0V$ to 3.6V or $D_{OUT-} = 0V$ to 3.6V | | | ± 20 | μA |
| V_{IC} | Common Mode Voltage Range | $ V_{ID} = 100 \text{ mV}$ to V_{CC} | $0V + V_{ID} /2$ | | $V_{CC} - (V_{ID} /2)$ | V |
| C_{IN} | Input Capacitance | | | 2.6 | | pF |
| | | Enable Input | | 2.1 | | pF |
| | | LVDS Input | | 2.8 | | pF |
| C_{OUT} | Output Capacitance | | | 2.8 | | pF |
| V_{BB} | Output Reference Voltage | $V_{CC} = 3.3V, I_{BB} = 0$ to $-275 \mu A$ | 1.125 | 1.2 | 1.375 | V |

Note 2: All typical values are at $T_A = 25^\circ C$ and with $V_{CC} = 3.3V$.

AC Electrical Characteristics

Over supply voltage and operating temperature ranges, unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ (Note 3) | Max | Units | |
|--------------|---|--|--|--------------|------|-------|-----|
| t_{PLHD} | Differential Output Propagation Delay LOW-to-HIGH | $R_L = 100 \Omega, C_L = 5 \text{ pF},$ $V_{ID} = 200 \text{ mV to } 450 \text{ mV},$ $V_{IC} = V_{ID} /2 \text{ to } V_{CC} - (V_{ID} /2),$ Duty Cycle = 50%, See Figure 1 and Figure 3 | 0.75 | 1.1 | 1.75 | ns | |
| t_{PHLD} | Differential Output Propagation Delay HIGH-to-LOW | | 0.75 | 1.1 | 1.75 | ns | |
| t_{TLHD} | Differential Output Rise Time (20% to 80%) | | 0.29 | 0.4 | 0.58 | ns | |
| t_{THLD} | Differential Output Fall Time (80% to 20%) | | 0.29 | 0.4 | 0.58 | ns | |
| $t_{SK(P)}$ | Pulse Skew $ t_{PLH} - t_{PHL} $ | | | | 0.02 | 0.2 | ns |
| $t_{SK(LH)}$ | Channel-to-Channel Skew (Note 4) | | | | 0.02 | 0.15 | ns |
| $t_{SK(HL)}$ | Channel-to-Channel Skew (Note 4) | | | | 0.02 | 0.15 | ns |
| $t_{SK(PP)}$ | Part-to-Part Skew (Note 5) | | | | | 0.5 | ns |
| f_{MAX} | Maximum Frequency (Note 6)(Note 7) | | | 400 | 800 | | MHz |
| t_{PZH} | Differential Output Enable Time from Z to HIGH | | $R_L = 100 \Omega, C_L = 5 \text{ pF},$ See Figure 2 and Figure 3 | | 2.2 | 5 | ns |
| t_{PZH} | Differential Output Enable Time from Z to LOW | | | 2.5 | 5 | ns | |
| t_{PHZ} | Differential Output Disable Time from HIGH to Z | | | 1.8 | 5 | ns | |
| t_{PLZ} | Differential Output Disable Time from LOW to Z | | | 2.1 | 5 | ns | |
| t_{DJ} | LVDS Data Jitter, Deterministic | $V_{ID} = 300 \text{ mV}, \text{PRBS} = 2^{23} - 1,$ $V_{IC} = 1.2 \text{ V at } 800 \text{ Mbps}$ | | 85 | 135 | ps | |
| t_{RJ} | LVDS Clock Jitter, Random (RMS) | $V_{ID} = 300 \text{ mV},$ $V_{IC} = 1.2 \text{ V at } 400 \text{ MHz}$ | | 2.1 | 3.5 | ps | |

Note 3: All typical values are at $T_A = 25^\circ\text{C}$ and with $V_{CC} = 3.3\text{V}$.

Note 4: $t_{SK(LH)}, t_{SK(HL)}$ is the skew between specified outputs of a single device when the outputs have identical loads and are switching in the same direction.

Note 5: $t_{SK(PP)}$ is the magnitude of the difference in propagation delay times between any specified terminals of two devices switching in the same direction (either Low-to-HIGH or HIGH-to-LOW) when both devices operate with the same supply voltage, same temperature, and have identical test circuits.

Note 6: Passing criteria for maximum frequency is the output $V_{OD} > 200 \text{ mV}$ and the duty cycle is 45% to 55% with all channels switching.

Note 7: Output loading is transmission line environment only; C_L is $< 1 \text{ pF}$ of stray test fixture capacitance.

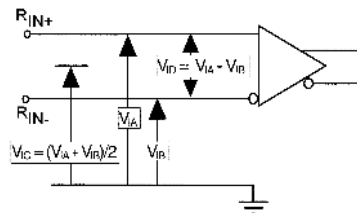


FIGURE 1. Differential Receiver Voltage Definitions and Propagation and Transition Time Test Circuit

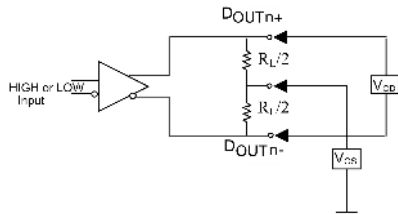
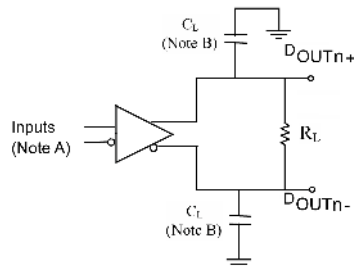


FIGURE 2. Differential Driver DC Test Circuit



Note A: All LVDS input pulses have frequency = 10 MHz, t_r or $t_f < 0.5 \text{ ns}$

Note B: C_L includes all probe and test fixture capacitances

FIGURE 3. Differential Driver Propagation Delay and Transition Time Test Circuit

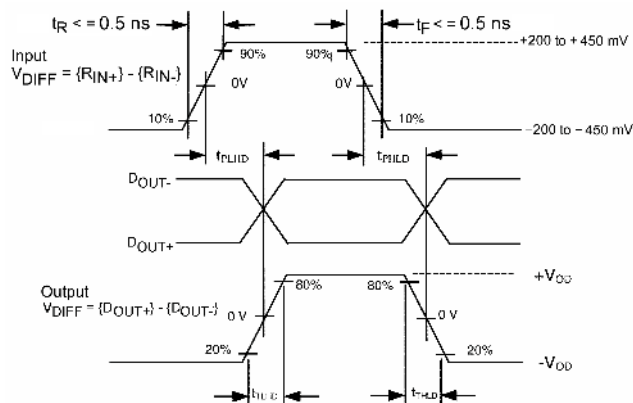
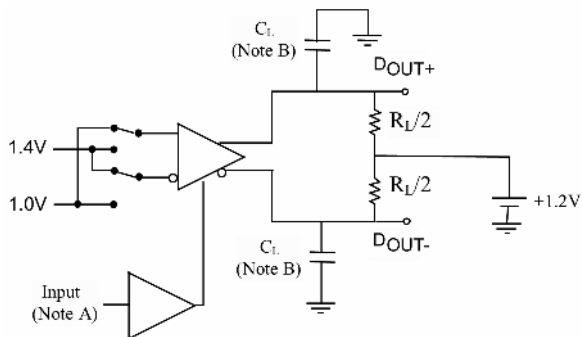


FIGURE 4. AC Waveform



Note A: All LVTTTL input pulses have frequency = 10MHz, t_R or t_F < 2 ns
 Note B: C_1 includes all probe and jig capacitances

FIGURE 5. Differential Driver Enable and Disable Circuit

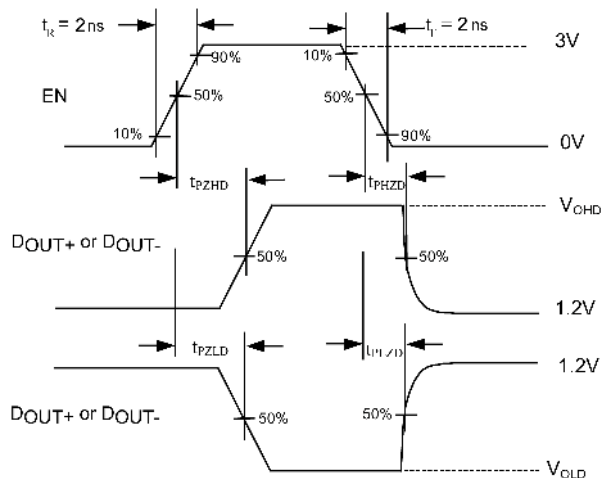
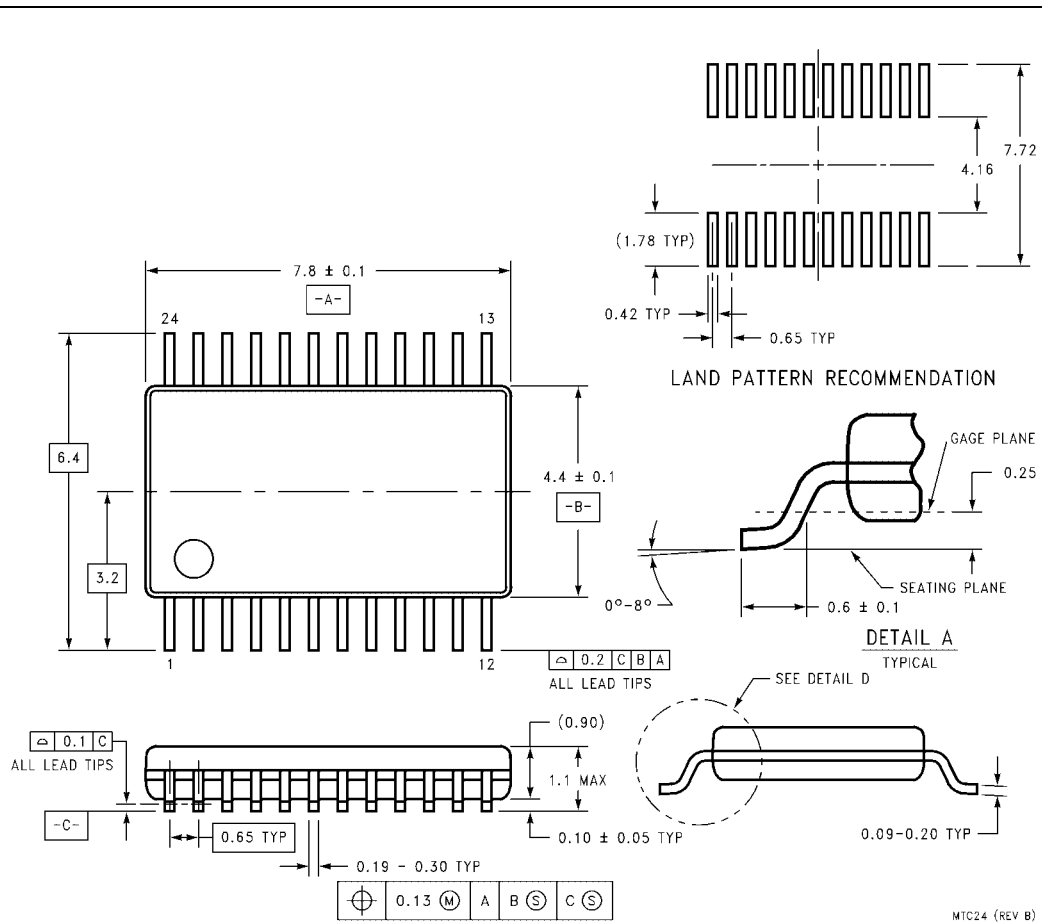


FIGURE 6. Enable and Disable AC Waveforms



24-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC24

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:

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 to 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.

www.fairchildsemi.com

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