



Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at  
[www.onsemi.com](http://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](http://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.



# H11L1M, H11L2M, H11L3M 6-Pin DIP Schmitt Trigger Output Optocoupler

## Features

- High Data Rate, 1 MHz Typical (NRZ)
- Free from Latch-up and Oscillation Throughout Voltage and Temperature Ranges
- Microprocessor Compatible Drive
- Logic Compatible Output Sinks 16 mA at 0.4 V Maximum
- Guaranteed On/Off Threshold Hysteresis
- Wide Supply Voltage Capability, Compatible with All Popular Logic Systems
- Safety and Regulatory Approvals:
  - UL1577, 4,170 VAC<sub>RMS</sub> for 1 Minute
  - DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

## Description

The H11LXM series has a high-speed integrated circuit detector optically coupled to a gallium-arsenide infrared emitting diode. The output incorporates a Schmitt trigger, which provides hysteresis for noise immunity and pulse shaping. The detector circuit is optimized for simplicity of operation and utilizes an open-collector output for maximum application flexibility.

## Applications

- Logic-to-Logic Isolator
- Programmable Current Level Sensor
- Line Receiver—Eliminate Noise and Transient Problems
- AC to TTL Conversion—Square Wave Shaping
- Digital Programming of Power Supplies
- Interfaces Computers with Peripherals

## Schematic

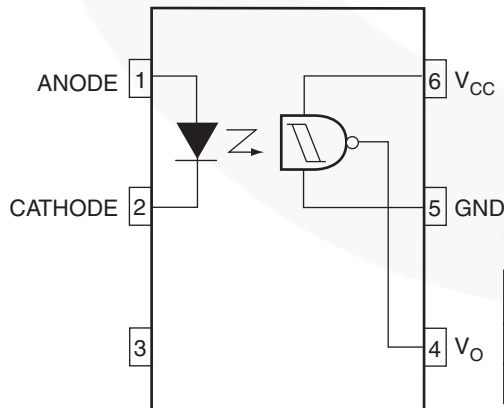


Figure 1. Schematic

Truth Table

Input	Output
H	L
L	H

## Package Outlines

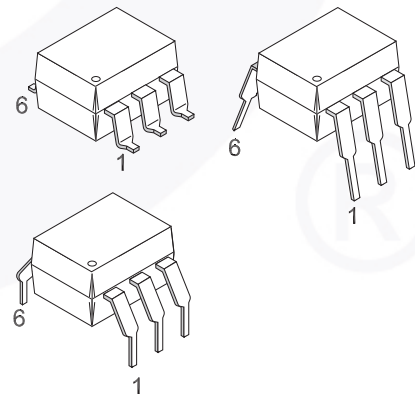


Figure 2. Package Outlines

## Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V <sub>RMS</sub>	I–IV
	< 300 V <sub>RMS</sub>	I–IV
Climatic Classification		55/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V <sub>PR</sub>	Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC	1360	V <sub>peak</sub>
	Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC	1594	V <sub>peak</sub>
V <sub>IORM</sub>	Maximum Working Insulation Voltage	850	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over-Voltage	6000	V <sub>peak</sub>
	External Creepage	≥ 7	mm
	External Clearance	≥ 7	mm
	External Clearance (for Option TV, 0.4" Lead Spacing)	≥ 10	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.5	mm
T <sub>S</sub>	Case Temperature <sup>(1)</sup>	175	°C
I <sub>S,INPUT</sub>	Input Current <sup>(1)</sup>	350	mA
P <sub>S,OUTPUT</sub>	Output Power <sup>(1)</sup>	800	mW
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V <sup>(1)</sup>	> 10 <sup>9</sup>	Ω

### Note:

1. Safety limit values – maximum values allowed in the event of a failure.

## 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.  $T_A = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameters	Value	Units
<b>Total Device</b>			
$T_{\text{STG}}$	Storage Temperature	-40 to +125	$^\circ\text{C}$
$T_{\text{OPR}}$	Operating Temperature	-40 to +85	$^\circ\text{C}$
$T_{\text{J}}$	Junction Temperature	-40 to +125	$^\circ\text{C}$
$T_{\text{SOL}}$	Lead Solder Temperature	260 for 10 seconds	$^\circ\text{C}$
$P_{\text{D}}$	Total Device Power Dissipation at $25^\circ\text{C}$	250	mW
	Derate Above $25^\circ\text{C}$	2.94	mW/ $^\circ\text{C}$
<b>Emitter</b>			
$I_{\text{F}}$	Continuous Forward Current	30	mA
$V_{\text{R}}$	Reverse Voltage	6	V
$I_{\text{F(pk)}}$	Forward Current – Peak (1 $\mu\text{s}$ pulse, 300 pps)	100	mA
$P_{\text{D}}$	LED Power Dissipation	60	mW
<b>Detector</b>			
$P_{\text{D}}$	Detector Power Dissipation	150	mW
$V_{\text{O}}$	$V_{45}$ Allowed Range	0 to 16	V
$V_{\text{CC}}$	$V_{65}$ Allowed Range	3 to 16	V
$I_{\text{O}}$	$I_4$ Output Current	50	mA

## Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise specified.

### Individual Component Characteristics

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Units
<b>Emitter</b>							
$V_F$	Input Forward Voltage	$I_F = 10\text{ mA}$	All		1.2	1.5	V
		$I_F = 0.3\text{ mA}$		0.75	1.0		
$I_R$	Reverse Current	$V_R = 3\text{ V}$	All			10	$\mu\text{A}$
$C_J$	Capacitance	$V = 0, f = 1.0\text{ MHz}$	All			100	pF
<b>Detector</b>							
$V_{CC}$	Operating Voltage Range		All	3		15	V
$I_{CC(\text{off})}$	Supply Current	$I_F = 0, V_{CC} = 5\text{ V}$	All		1.6	5.0	mA
$I_{OH}$	Output Current, High	$I_F = 0, V_{CC} = V_O = 15\text{ V}$	All			100	$\mu\text{A}$

### Transfer Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Units
<b>DC Characteristics</b>							
$I_{CC(\text{on})}$	Supply Current	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}$	All		1.6	5.0	mA
$V_{OL}$	Output Voltage, Low	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}, I_F = I_{F(\text{on})}\text{ max.}$	All		0.2	0.4	V
$I_{F(\text{on})}$	Turn-On Threshold Current <sup>(2)</sup>	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$	H11L1M			1.6	mA
			H11L2M			10.0	
			H11L3M			5.0	
$I_{F(\text{off})}$	Turn-Off Threshold Current	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$	All	0.3	1.0		mA
$I_{F(\text{off})}/I_{F(\text{on})}$	Hysteresis Ratio	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$	All	0.50	0.75	0.90	
<b>AC Characteristics, Switching Speed</b>							
$t_{\text{on}}$	Turn-On Time	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}, I_F = I_{F(\text{on})}, T_A = 25^\circ\text{C}$	All		1.0	4.0	$\mu\text{s}$
$t_f$	Fall Time	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}, I_F = I_{F(\text{on})}, T_A = 25^\circ\text{C}$	All		0.1		$\mu\text{s}$
$t_{\text{off}}$	Turn-Off Time	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}, I_F = I_{F(\text{on})}, T_A = 25^\circ\text{C}$	All		1.2	4.0	$\mu\text{s}$
$t_r$	Rise Time	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}, I_F = I_{F(\text{on})}, T_A = 25^\circ\text{C}$	All		0.1		$\mu\text{s}$
	Data Rate		All		1.0		MHz

### Isolation Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{\text{ISO}}$	Input-Output Isolation Voltage	$t = 1\text{ Minute}$	4170			$V_{AC_{RMS}}$
$C_{\text{ISO}}$	Isolation Capacitance	$V_{\text{I-O}} = 0\text{ V}, f = 1\text{ MHz}$		0.4	0.6	pF
$R_{\text{ISO}}$	Isolation Resistance	$V_{\text{I-O}} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$	$10^{11}$			$\Omega$

#### Note:

- Maximum  $I_{F(\text{ON})}$  is the maximum current required to trigger the output. For example, a 1.6 mA maximum trigger current would require the LED to be driven at a current greater than 1.6 mA to guarantee the device turns on. A 10% guard band is recommended to account for degradation of the LED over its lifetime. The maximum allowable LED drive current is 30 mA.

### Typical Performance Curves

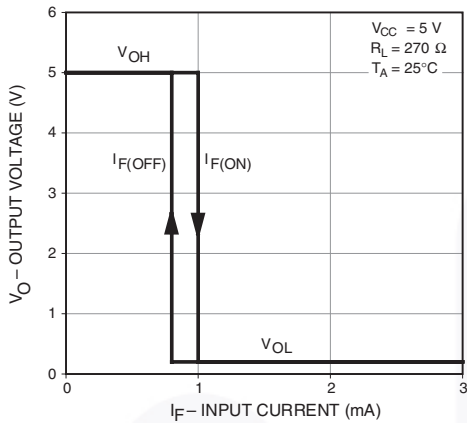


Figure 3. Transfer Characteristics



Figure 4. Threshold Current vs. Supply Voltage



Figure 5. Threshold Current vs. Supply Temperature

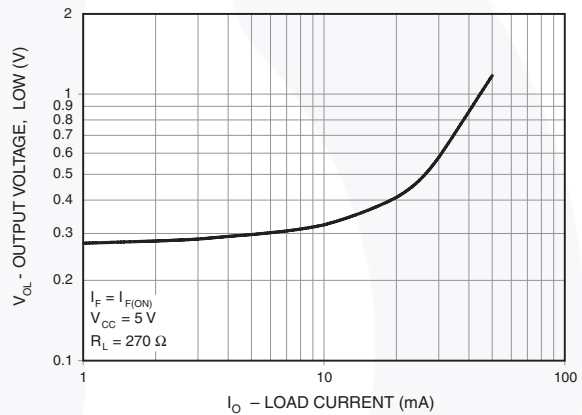


Figure 6. Output Voltage, Low vs. Load Current



Figure 7. Supply Current vs. Supply Voltage

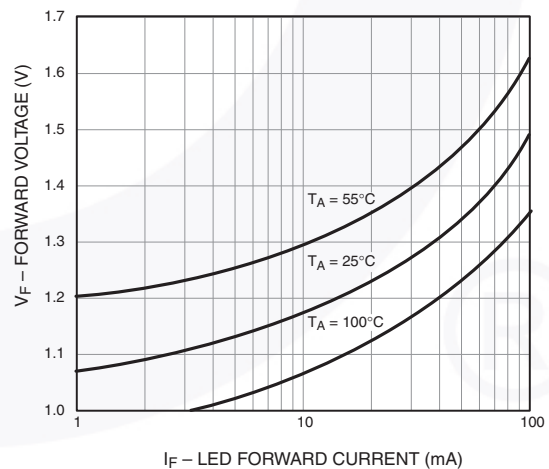


Figure 8. LED Forward Voltage vs. Forward Current

Typical Performance Curves (Continued)

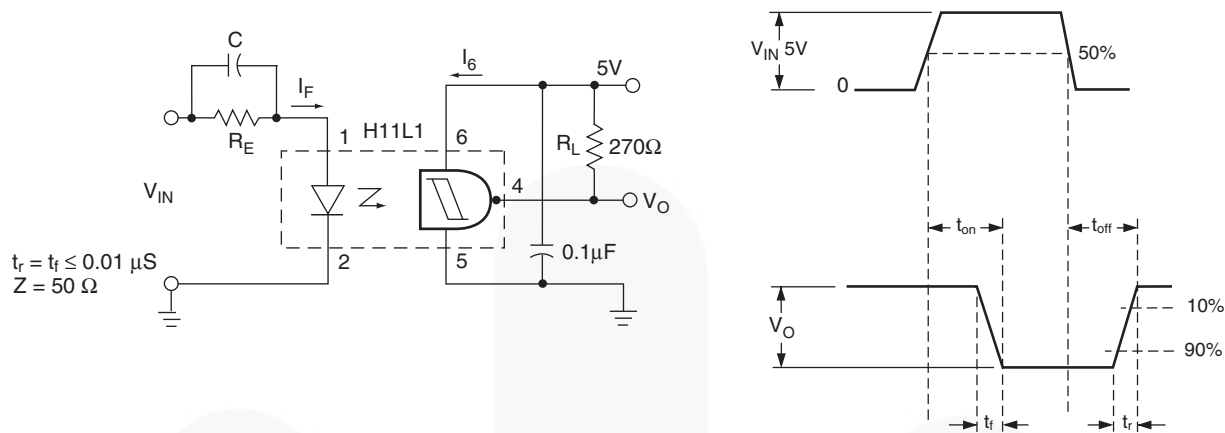


Figure 9. Switching Test Circuit and Waveforms

Reflow Profile

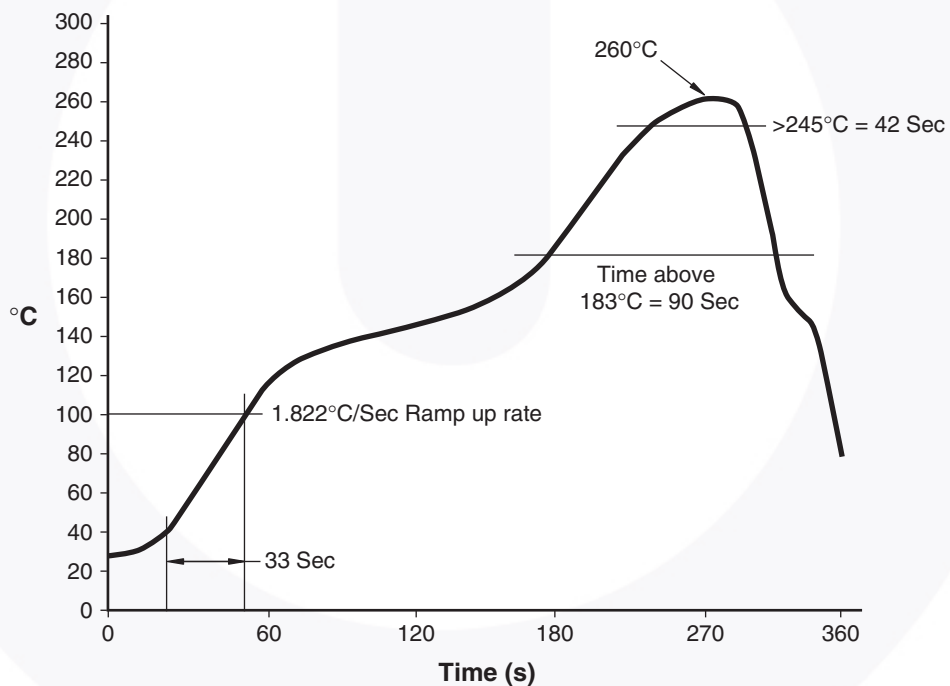


Figure 10. Reflow Profile

## Ordering Information

Part Number	Package	Packing Method
H11L1M	DIP 6-Pin	Tube (50 Units)
H11L1SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
H11L1SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
H11L1VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11L1SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11L1SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
H11L1TVM	DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

**Note:**

3. The product orderable part number system listed in this table also applies to the H11L2M and H11L3M product families.

## Marking Information

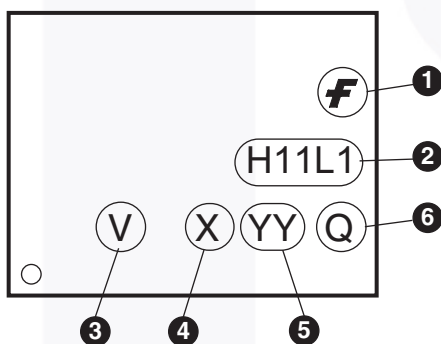


Figure 11. Top Mark

Table 1. Top Mark Definitions

1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., "4"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code





NOTES:

- A) NO STANDARD APPLIES TO THIS PACKAGE.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION
- D) DRAWING FILENAME AND REVISION: MKT-N06BREV4.





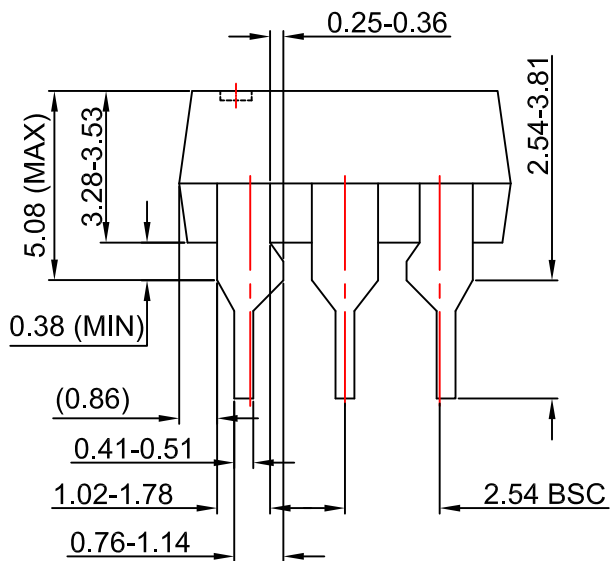
LAND PATTERN RECOMMENDATION



NOTES:

- A) NO STANDARD APPLIES TO THIS PACKAGE.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION
- D) DRAWING FILENAME AND REVISION : MKT-N06CREV4.





NOTES:

- A) NO STANDARD APPLIES TO THIS PACKAGE.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION
- D) DRAWING FILENAME AND REVISION: MKT-N06Drev4



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](http://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](mailto: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](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative