

# 6-Pin DIP Schmitt Trigger Output Optocoupler

## H11L1M, H11L2M, H11L3M

### 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.

### 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

### 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



**ON Semiconductor®**

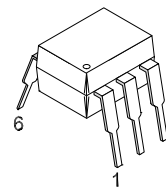
[www.onsemi.com](http://www.onsemi.com)

### SCHEMATIC

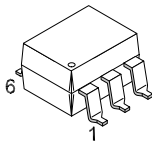


### Truth Table

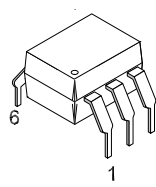
Input	Output
H	L
L	H



**PDIP6  
CASE 646BX**



**PDIP6  
CASE 646BY**



**PDIP6  
CASE 646BZ**

### MARKING DIAGRAM



- H11L1 = Specific Device Code
- V = DIN EN/IEC40747-5-5 Option
- Y = Year Code
- WW = Work Week
- Q = Assembly Package Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# H11L1M, H11L2M, H11L3M

## 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 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	Units
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 (Note 1)	175	°C
I <sub>S,INPUT</sub>	Input Current (Note 1)	350	mA
P <sub>S,OUTPUT</sub>	Output Power (Note 1)	800	mW
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V (Note 1)	>10 <sup>9</sup>	Ω

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

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameters	Value	Units
--------	------------	-------	-------

### TOTAL DEVICE

T <sub>STG</sub>	Storage Temperature	-40 to +125	°C
T <sub>OPR</sub>	Operating Temperature	-40 to +85	°C
T <sub>J</sub>	Junction Temperature	-40 to +125	°C
T <sub>SOL</sub>	Lead Solder Temperature	260 for 10 seconds	°C
P <sub>D</sub>	Total Device Power Dissipation at 25°C Derate Above 25°C	250	mW
		2.94	mW/°C

### EMITTER

I <sub>F</sub>	Continuous Forward Current	30	mA
V <sub>R</sub>	Reverse Voltage	6	V
I <sub>F(pk)</sub>	Forward Current – Peak (1 μs pulse, 300 pps)	100	mA
P <sub>D</sub>	LED Power Dissipation	60	mW

### DETECTOR

P <sub>D</sub>	Detector Power Dissipation	150	mW
V <sub>O</sub>	V <sub>45</sub> Allowed Range	0 to 16	V
V <sub>CC</sub>	V <sub>65</sub> Allowed Range	3 to 16	V
I <sub>O</sub>	I <sub>4</sub> Output Current	50	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

# H11L1M, H11L2M, H11L3M

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Device	Min	Typ	Max	Units
--------	-----------	-----------------	--------	-----	-----	-----	-------

### INDIVIDUAL COMPONENT CHARACTERISTICS

#### Emitter

$V_F$	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

#### Detector

$V_{CC}$	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

#### DC Characteristics

$I_{CC(\text{on})}$	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 (Note 2)	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$	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	

#### AC Characteristics, Switching Speed

$t_{on}$	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		All		0.1		
$t_{off}$	Turn-Off Time		All		1.2	4.0	
$t_r$	Rise Time		All		0.1		
	Data Rate		All		1.0		MHz

### ISOLATION CHARACTERISTICS

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

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. 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.

# H11L1M, H11L2M, H11L3M

## TYPICAL PERFORMANCE CURVES



Figure 1. Transfer Characteristics



Figure 2. Threshold Current vs. Supply Voltage

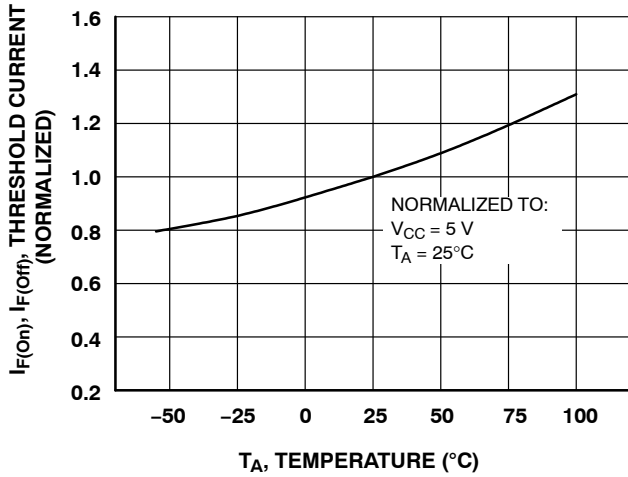


Figure 3. Threshold Current vs. Supply Temperature



Figure 4. Output Voltage, Low vs. Load Current

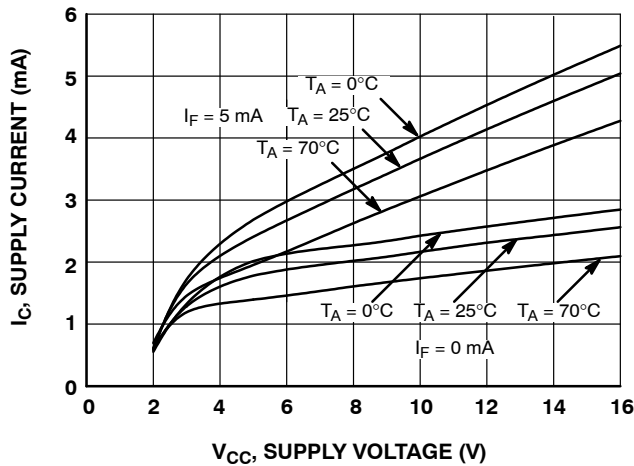


Figure 5. Supply Current vs. Supply Voltage

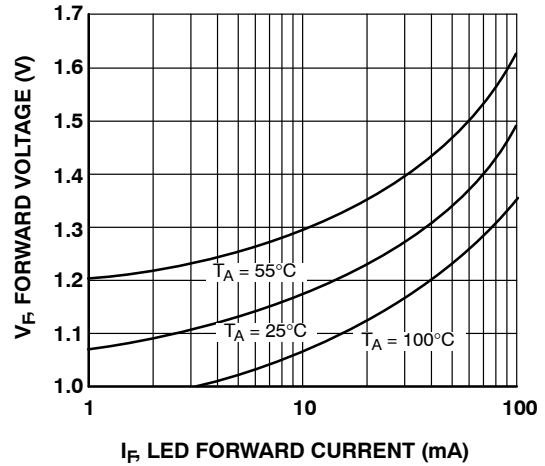


Figure 6. LED Forward Voltage vs. Forward Current

# H11L1M, H11L2M, H11L3M

## TYPICAL PERFORMANCE CURVES (continued)

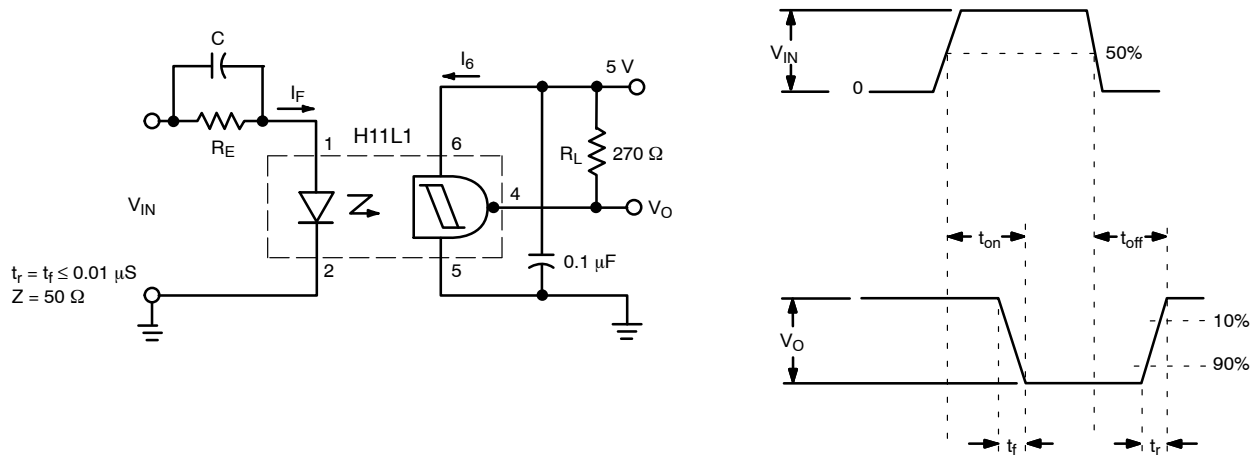


Figure 7. Switching Test Circuit and Waveforms

## REFLOW PROFILE

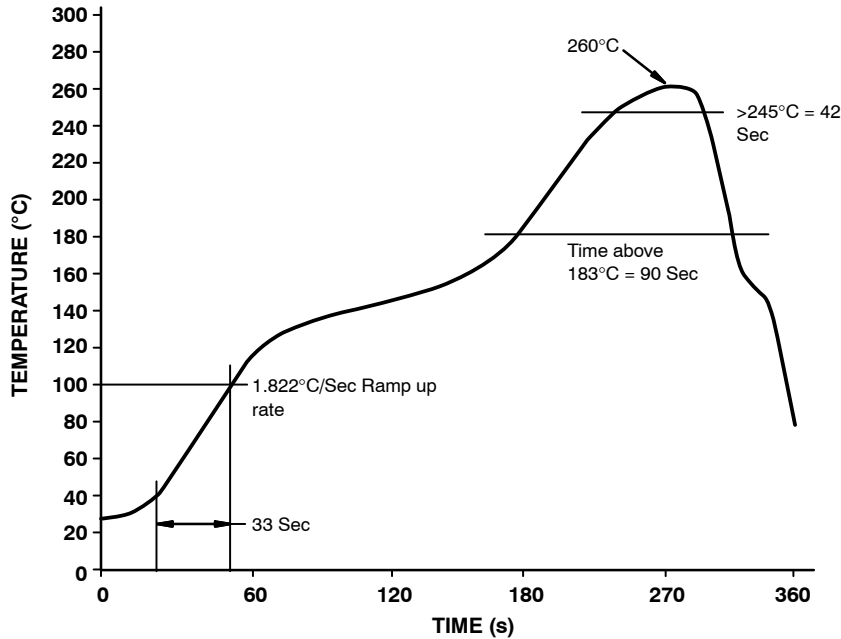


Figure 8. Reflow Profile

## PACKAGE MARKING AND ORDERING INFORMATION

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

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



PDIP6 8.51x6.35, 2.54P  
CASE 646BX  
ISSUE O

DATE 31 JUL 2016



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

<b>DOCUMENT NUMBER:</b>	<b>98AON13449G</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>PDIP6 8.51X6.35, 2.54P</b>	<b>PAGE 1 OF 1</b>

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 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



### PDIP6 8.51x6.35, 2.54P

#### CASE 646BY

#### ISSUE A

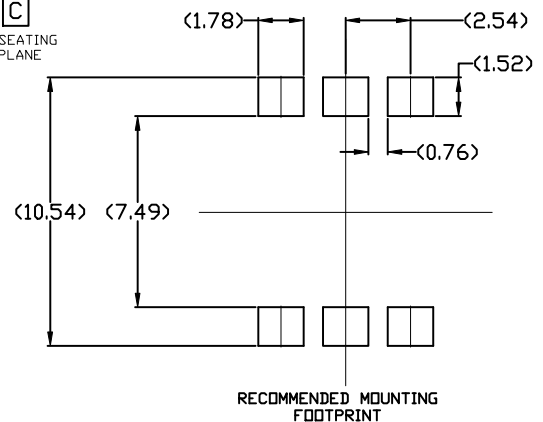
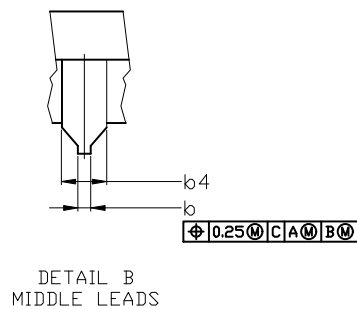
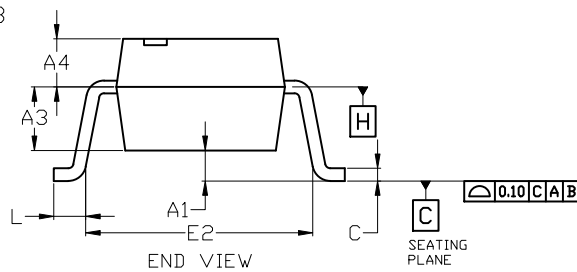
DATE 15 JUL 2019



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS A, A1, AND L ARE MEASURED WITH THE PACKAGE SEATED.
4. DIMENSIONS D, D1, AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 2.54mm.
5. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).
6. CENTER LINE OF CORNER LEADS ARE LOCATED BY LOCATING THE CENTER OF FEATURE b2 AND b3.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	4.80
A1	0.38	---	---
A2	3.28	3.40	3.53
A3	2.49 REF		
A4	1.89 REF		
b	0.41	0.46	0.51
b1	0.76	0.92	1.14
b2	0.25	0.28	0.36
b3	1.02	1.40	1.78
b4	1.778 REF		
c	0.20	0.25	0.30
D	8.13	8.51	8.89
D1	0.86 REF		
E	6.10	6.35	6.60
E1	8.43	9.17	9.90
E2	8.13 REF		
e	2.54 BSC		
L	0.16	0.52	0.88



For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

<b>DOCUMENT NUMBER:</b>	<b>98AON13450G</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>PDIP6 8.51x6.35, 2.54P</b>	<b>PAGE 1 OF 1</b>

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

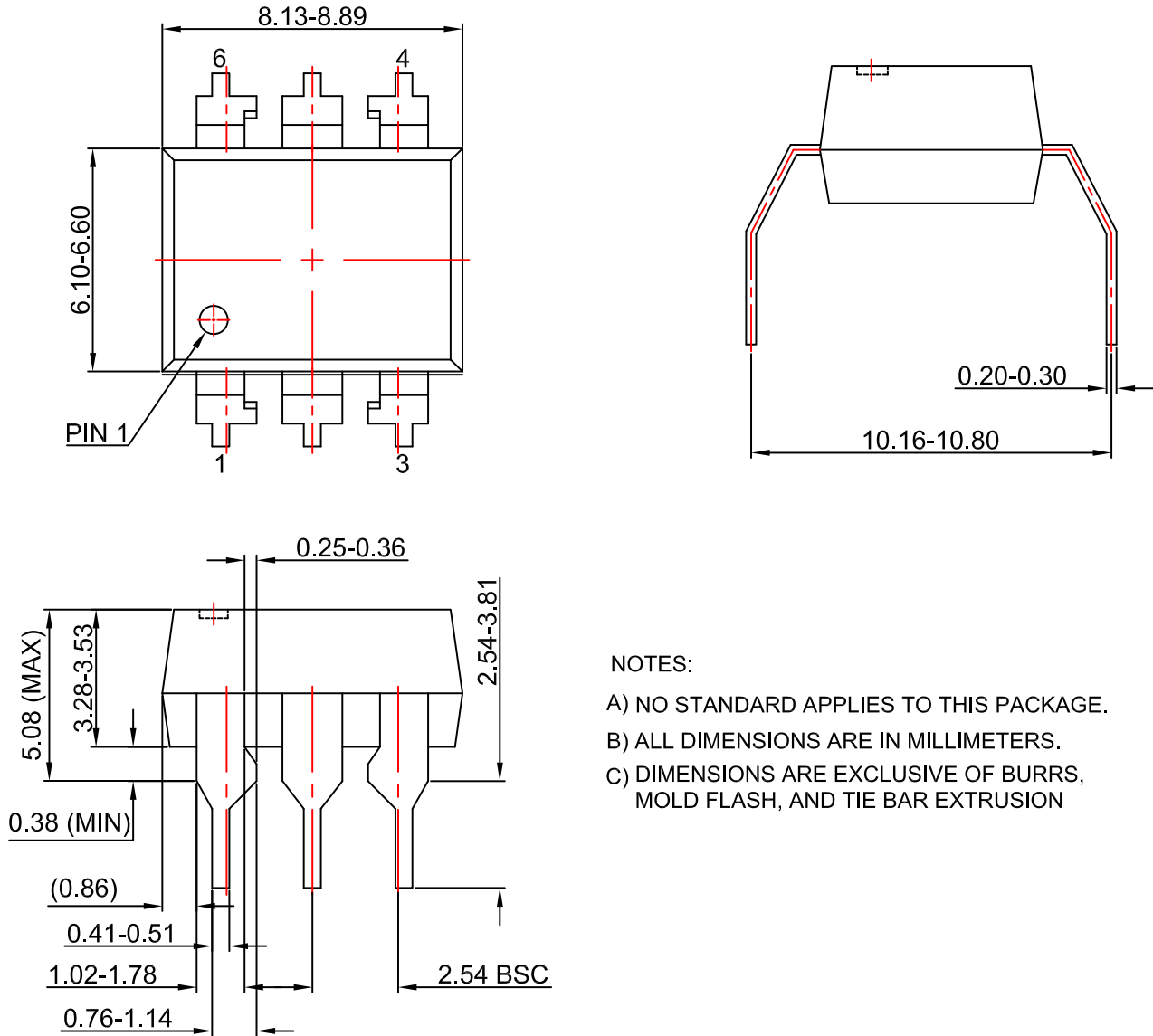
**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

ON Semiconductor®



**PDIP6 8.51x6.35, 2.54P**  
**CASE 646BZ**  
**ISSUE O**

DATE 31 JUL 2016



**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

<b>DOCUMENT NUMBER:</b>	<b>98AON13451G</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>PDIP6 8.51X6.35, 2.54P</b>	<b>PAGE 1 OF 1</b>

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 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.



**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'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). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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 **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** 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 **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at [www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)