

Photo FET Optocouplers

H11F1M, H11F2M, H11F3M

General Description

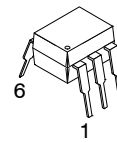
The H11FXM series consists of a Gallium–Aluminum–Arsenide IRED emitting diode coupled to a symmetrical bilateral silicon photo–detector. The detector is electrically isolated from the input and performs like an ideal isolated FET designed for distortion–free control of low level AC and DC analog signals. The H11FXM series devices are mounted in dual in–line packages.

Features

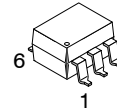
- As a Remote Variable Resistor:
 - ◆ $\leq 100 \Omega$ to $\geq 300 M\Omega$
 - ◆ ≤ 15 pF Shunt Capacitance
 - ◆ $\geq 100 G\Omega$ I/O Isolation Resistance
- As an Analog Switch:
 - ◆ Extremely Low Offset Voltage
 - ◆ 60 V_{pk-pk} Signal Capability
 - ◆ No Charge Injection or Latch–Up
 - ◆ UL Recognized (File #E90700)
- These are Pb–Free Devices

Application

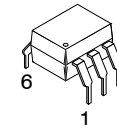
- As a Remote Variable Resistor:
 - ◆ Isolated Variable Attenuator
 - ◆ Automatic Gain Control
 - ◆ Active Filter Fine Tuning/Band Switching
- As an Analog Switch:
 - ◆ Isolated Sample and Hold Circuit
 - ◆ Multiplexed, Optically Isolated A/D Conversion



PDIP6 8.51x6.35, 2.54P
CASE 646BX

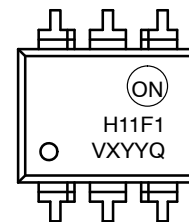


PDIP6 8.51x6.35, 2.54P
CASE 646BY



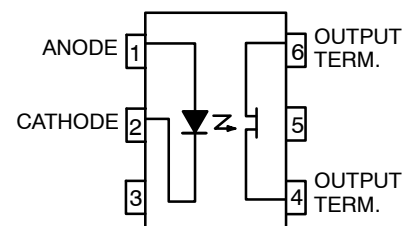
PDIP6 8.51x6.35, 2.54P
CASE 646BZ

MARKING DIAGRAM



- H11F1 = Specific Device Code
- V = VDE Mark (Only appears on parts ordered with VDE option – See order entry table)
- X = One–Digit Year Code, e.g., “7”
- YY = Two Digit Work Week Ranging from “01” to “53”
- Q = Assembly Package Code

SCHEMATIC



ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

H11F1M, H11F2M, H11F3M

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	< 150 Vrms	I-IV
	< 300 Vrms	I-IV
Climatic Classification		55/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V _{PR}	Input to Output Test Voltage, Method A, V _{IORM} × 1.6 = V _{PR} , Type and Sample Test with t _m = 10 s, Partial Discharge < 5 pC	1360	V _{peak}
	Input to Output Test Voltage, Method B, V _{IORM} × 1.875 = V _{PR} , 100% Production Test with t _m = 1 s, Partial Discharge < 5 pC	1594	V _{peak}
V _{IORM}	Maximum Working Insulation Voltage	850	V _{peak}
V _{IOTM}	Highest Allowable Over Voltage	6,000	V _{peak}
	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 _S	Case Temperature (Note 1)	175	°C
I _{S,INPUT}	Input Current (Note 1)	350	mA
P _{S,OUTPUT}	Output Power (Note 1)	800	mW
R _{IO}	Insulation Resistance at T _S , V _{IO} = 500 V (Note 1)	>10 ⁹	Ω

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

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise specified)

Symbol	Parameter	Value	Unit
--------	-----------	-------	------

TOTAL DEVICE

T _{STG}	Storage Temperature	-40 to +125	°C
T _{OPR}	Operating Temperature	-40 to +100	°C
T _{SOL}	Lead Solder Temperature	260 for 10 seconds	°C

EMITTER

I _F	Continuous Forward Current	60	mA
V _R	Reverse Voltage	5	V
I _{F(pk)}	Forward Current – Peak (10 μs Pulse, 1% Duty Cycle)	1	A
P _D	LED Power Dissipation Ambient 25°C Ambient	100	mW
	Derate Linearly from 25°C	1.33	mW/°C

DETECTOR

P _D	Detector Power Dissipation at 25°C	300	mW
	Derate Linearly from 25°C	4.0	mW/°C
BV ₄₋₆	Breakdown Voltage (Either Polarity)	H11F1M, H11F2M	±30 V
		H11F3M	±15 V
I ₄₋₆	Continuous Detector Current (Either Polarity)	±100	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.

H11F1M, H11F2M, H11F3M

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

INDIVIDUAL COMPONENT CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ*	Max	Unit
EMITTER						
V _F	Input Forward Voltage	I _F = 16 mA	–	1.3	1.75	V
I _R	Reverse Leakage Current	V _R = 5 V	–	–	10	μA
C _J	Capacitance	V = 0 V, f = 1.0 MHz	–	50	–	pF

OUTPUT DETECTOR

BV ₄₋₆	Breakdown Voltage Either Polarity	H11F1M, H11F2M	I ₄₋₆ = 10 μA, I _F = 0	30	–	–	V	
		H11F3M		15	–	–		
I ₄₋₆	Off-State Dark Current			V ₄₋₆ = 15 V, I _F = 0	–	–	50	nA
				V ₄₋₆ = 15 V, I _F = 0, T _A = 100°C	–	–	50	μA
R ₄₋₆	Off-State Resistance			V ₄₋₆ = 15 V, I _F = 0	300	–	–	MΩ
C ₄₋₆	Capacitance			V ₄₋₆ = 15 V, I _F = 0, f = 1 MHz	–	–	15	pF

TRANSFER CHARACTERISTICS

Symbol	Characteristics	Test Conditions	Min	Typ*	Max	Unit
--------	-----------------	-----------------	-----	------	-----	------

DC CHARACTERISTICS

R ₄₋₆	On-State Resistance	H11F1M	I _F = 16 mA, I ₄₋₆ = 100 μA	–	–	200	Ω
		H11F2M		–	–	330	
		H11F3M		–	–	470	
R ₆₋₄	On-State Resistance	H11F1M	I _F = 16 mA, I ₆₋₄ = 100 μA	–	–	200	Ω
		H11F2M		–	–	330	
		H11F3M		–	–	470	
Resistance, Non-Linearity and Assymetry		I _F = 16 mA, I ₄₋₆ = 25 μA RMS, f = 1 kHz		–	2	–	%

AC CHARACTERISTICS

t _{on}	Turn-On Time	R _L = 50 Ω, I _F = 16 mA, V ₄₋₆ = 5 V	–	–	45	μs
t _{off}	Turn-Off Time	R _L = 50 Ω, I _F = 16 mA, V ₄₋₆ = 5 V	–	–	45	μs

ISOLATION CHARACTERISTICS

Symbol	Characteristics	Test Conditions	Min	Typ*	Max	Unit
V _{ISO}	Input-Output Isolation Voltage	t = 1 Minute	4170	–	–	VAC _{RMS}
R _{ISO}	Isolation Resistance	V _{I-O} = 500 VDC	10 ¹¹	–	–	Ω
C _{ISO}	Isolation Capacitance	f = 1 MHz	–	0.2	–	pF

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.

*All Typical values at T_A = 25°C.

H11F1M, H11F2M, H11F3M

TYPICAL PERFORMANCE CURVES

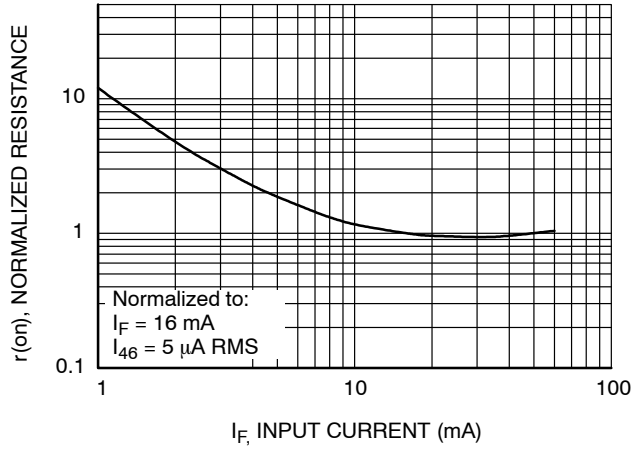


Figure 1. Resistance vs. Input Current

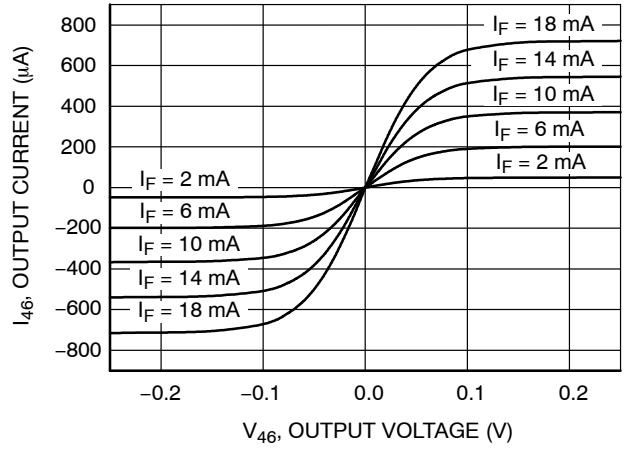


Figure 2. Output Characteristics

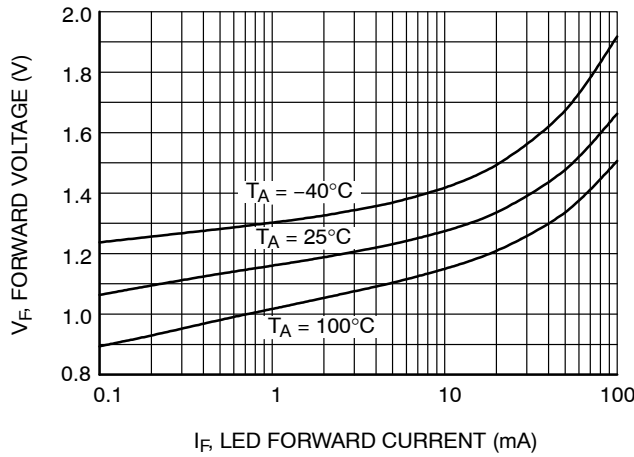


Figure 3. LED Forward Voltage vs. Forward Current

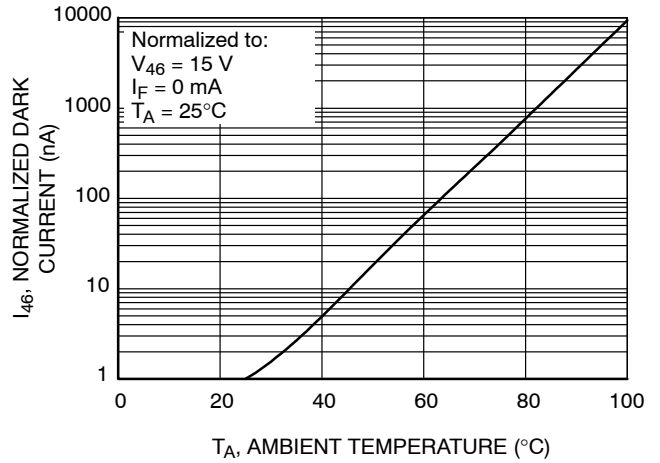


Figure 4. Off-State Current vs. Ambient Temperature

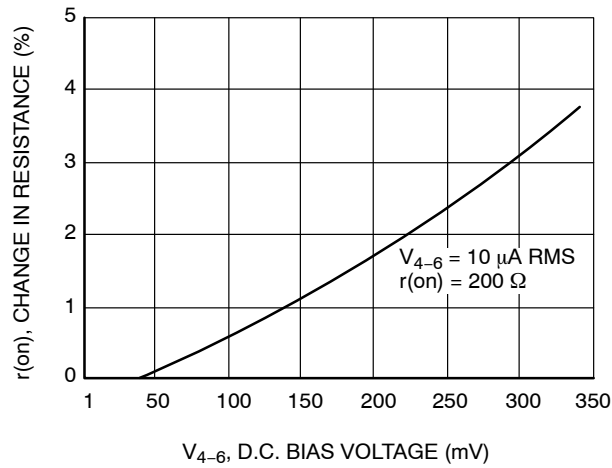


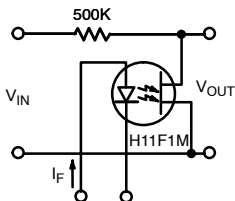
Figure 5. Resistive Non-Linearity vs. D.C. Bias

H11F1M, H11F2M, H11F3M

TYPICAL APPLICATIONS

As a Variable Resistor

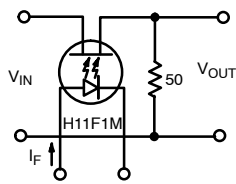
ISOLATED VARIABLE ATTENUATORS



LOW FREQUENCY

Dynamic Range 70 db

@ 10 kHz For $0 \leq I_F \leq 30$ mA



HIGH FREQUENCY

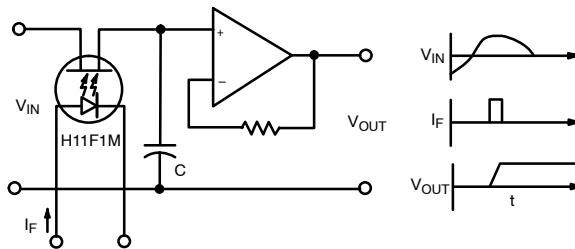
Dynamic Range 50 db

@ 1 MHz For $0 \leq I_F \leq 30$ mA

Distortion free attenuation of low level A.C. signals is accomplished by varying the I_{RED} current, I_F. Note the wide dynamic range and absence of coupling capacitors; D.C. level shifting or parasitic feedback to the controlling function.

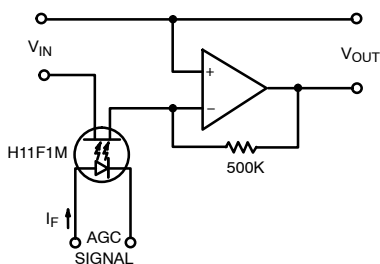
As an Analog Signal Switch

ISOLATED VARIABLE ATTENUATORS



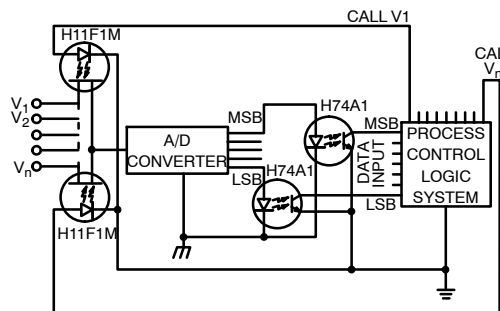
Accuracy and range are improved over conventional FET switches because the H11FXM has no charge injection from the control signal. The H11FXM also provides switching of either polarity input signal up to 30V magnitude.

AUTOMATIC GAIN CONTROL



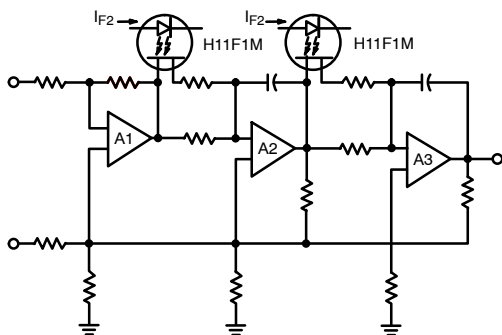
This simple circuit provides over 70db of stable gain control for an AGC signal range of from 0 to 30mA. This basic circuit can be used to provide programmable fade and attack for electronic music.

MULTIPLEXED, OPTICALLY-ISOATED A/D CONVERSION



The optical isolation, linearity and low offset voltage of the H11FXM allows the remote multiplexing of low level analog signals from such transducers as thermocouples, Hall effect devices, strain gauges, etc. to a single A/D converter.

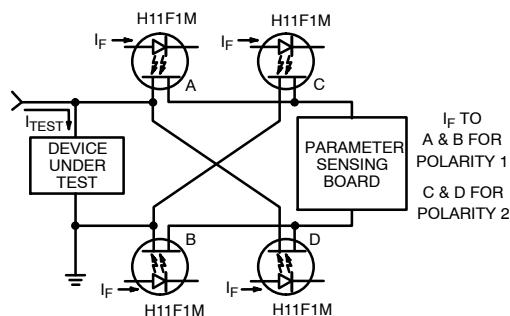
ACTIVE FILTER FINE TUNING/BAND SWITCHING



I_{F2} ADJUSTS f₁, I_{F2} ADJUSTS f₂

The linearity of resistance and the low offset voltage of the H11FXM allows the remote tuning or band-switching of active filters without switching glitches or distortion. This schematic illustrates the concept, with current to the H11F1M I_{RED}'s controlling the filter's transfer characteristic.

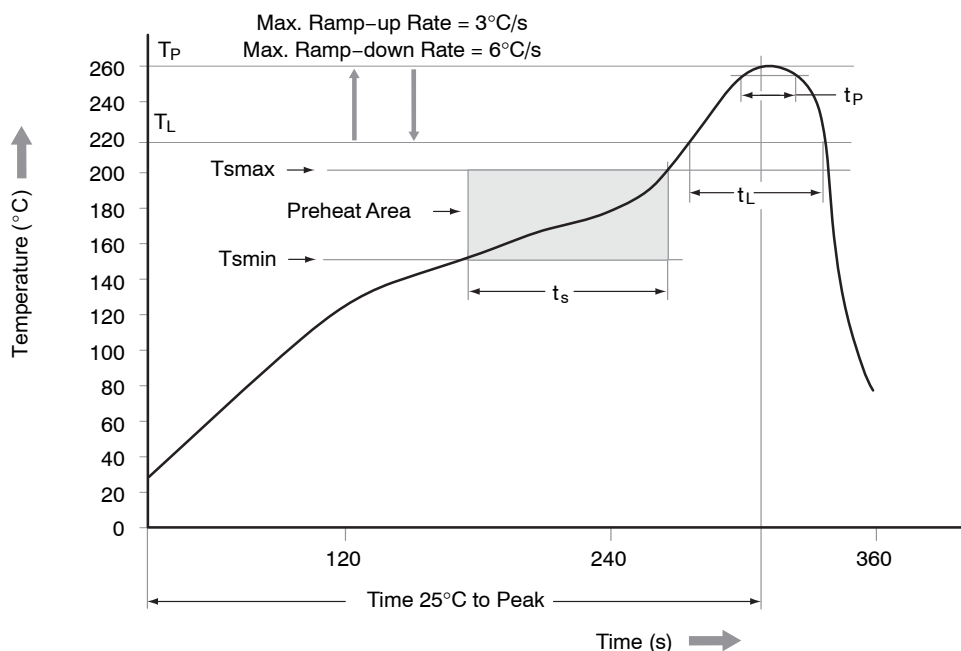
TEST EQUIPMENT - KELVIN CONTACT POLARITY



In many test equipment designs the auto polarity function uses reed relay contacts to switch the Kelvin Contact polarity. These reeds are normally one of the highest maintenance cost items due to sticking contacts and mechanical problems. The totally solid-State H11FXM eliminates these troubles while providing faster switching.

H11F1M, H11F2M, H11F3M

REFLOW PROFILE



Profile Feature	Pb-Free Assembly Profile
Temperature Min. (Tsmn)	150°C
Temperature Max. (Tsm)	200°C
Time (ts) from (Tsmn to Tsm)	60–120 seconds
Ramp-up Rate (tL to tp)	3°C/seconds max.
Liquidous Temperature (TL)	217°C
Time (tL) Maintained Above (TL)	60–150 seconds
Peak Body Package Temperature	260°C +0°C / -5°C
Time (tp) within 5°C of 260°C	30 seconds
Ramp-down Rate (Tp to TL)	6°C/seconds max.
Time 25°C to Peak Temperature	8 minutes max.

ORDERING INFORMATION

Option	Order Entry Identifier (Example)	Description
No option	H11F1M	Standard Through Hole Device
S	H11F1SM	Surface Mount Lead Bend
SR2	H11F1SR2M	Surface Mount; Tape and Reel
V	H11F1VM	IEC60747-5-5 approval
TV	H11F1TVM	IEC60747-5-5 approval, 0.4" Lead Spacing
SV	H11F1SVM	IEC60747-5-5 approval, Surface Mount
SR2V	H11F1SR2VM	IEC60747-5-5 approval, Surface Mount, Tape and Reel

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

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

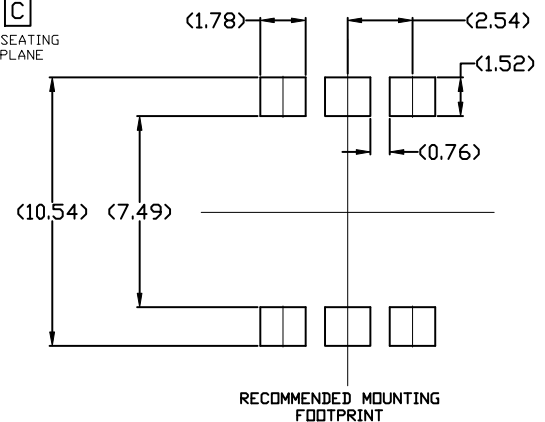
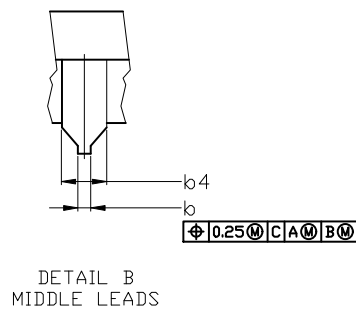
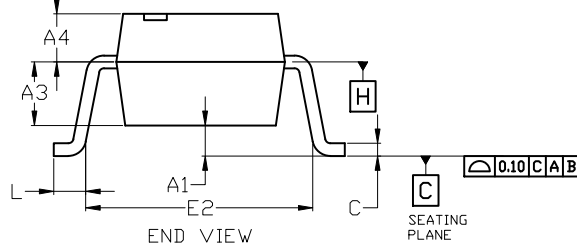
DATE 15 JUL 2019



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.

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

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.

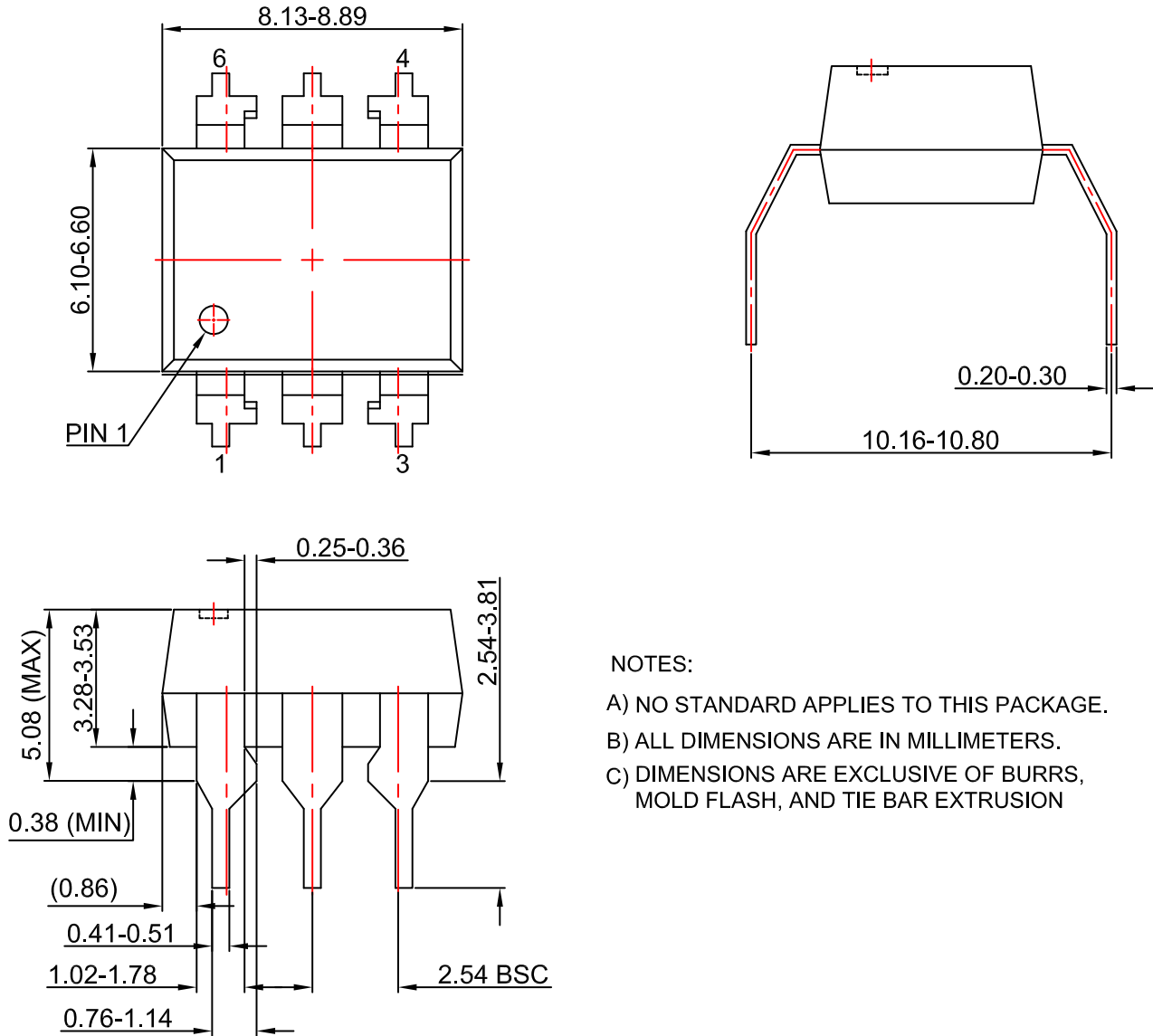
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

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

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

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales