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# HSMP-3816

Quad PIN Diode  $\pi$  Attenuator 300 kHz to 4 GHz  
in SOT 25 Package



## Data Sheet



Lead (Pb) Free  
RoHS 6 fully  
compliant



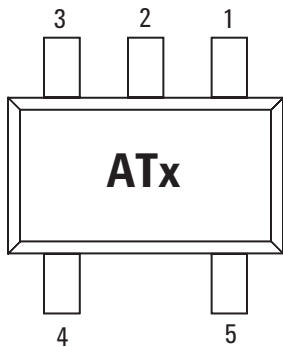
### Description

Avago Technologies' HSMP-3816 is a wideband, low insertion loss, high IIP3, Quad PIN Attenuator in a low cost surface mount SOT-25 package. It provides a good match and flat attenuation over an extremely wide band from 300 kHz to 4 GHz.

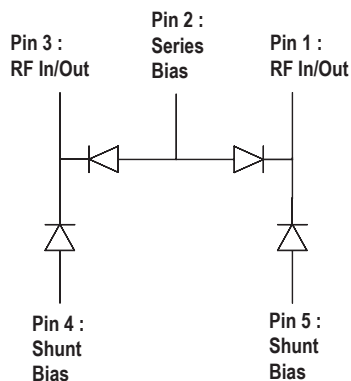
The SOT-25 packages gives a reduction in part count and takes up less space on board compared to multi package solutions.

Four PIN Diodes in one package encourages performance repeatability for improved production yield at board level.

### Package Marking and Pin connections



**Note:**  
Package marking provides orientation and identification  
"AT" = Device Code  
"x" = Month code indicates the month of manufacture



### Features

- 4 PIN Diodes in a SOT-25 package
- 300 kHz to 4 GHz usable frequency band
- High Linearity
- Low insertion Loss
- MSL-1 and Lead-free
- Tape & Reel packaging option available

### Specification At 1 GHz, V+=5V

- IIP3 = 45 dBm (Typical)
- Attenuation = 38 dB (Typical)
- Insertion Loss = -3 dB (Typical)
- Return Loss = -22 dB (Typical)

### Applications

- Broadband system application (i.e., CATV, WCDMA, etc)
- General purpose Voltage-Control-Attenuator for high linearity applications.

## Absolute Max Ratings <sup>[1]</sup>, Tc = +25°C

Symbol	Parameter	Unit	Abs Max
I <sub>f</sub>	Forward Current (1 μs Pulse)	Amp	1
P <sub>IV</sub>	Peak Inverse Voltage	V	100
T <sub>j</sub>	Junction Temperature	°C	150
T <sub>stg</sub>	Storage Temperature	°C	-60 to 150
θ <sub>lb</sub>	Thermal Resistance <sup>[2]</sup>	°C/W	167
P <sub>In</sub>	Input Power <sup>[3]</sup>	W	1.0

Notes:

1. Operation in excess of any one of these conditions may result in permanent damage to the device.
2. Thermal Resistance is measured from junction to board using IR method.
3. The Max Input Power is tested using demoboard as shown in Figure 1 at the worst-case (highest attenuation) bias condition of V<sub>+</sub>=5V, V<sub>c</sub>=0V.

## Electrical Specifications, Tc = +25°C (Each Diode)

	Minimum Breakdown Voltage V <sub>BR</sub> (V)	Maximum Total Capacitance C <sub>T</sub> (pF)	Minimum Resistance at I <sub>F</sub> = 0.01mA, R <sub>H</sub> (Ω)	Maximum Resistance at I <sub>F</sub> = 20mA, R <sub>L</sub> (Ω)	Maximum Resistance at I <sub>F</sub> = 100mA, R <sub>T</sub> (Ω)	Resistance at I <sub>F</sub> = 1mA, R <sub>M</sub> (Ω)
	100	0.35	1500	10	3.0	45 to 80
Test Conditions	V <sub>R</sub> = V <sub>BR</sub> Measure I <sub>R</sub> ≤ 10uA	V <sub>R</sub> = 50V f = 1MHz	I <sub>F</sub> = 0.01mA f = 100MHz	I <sub>F</sub> = 20mA f = 100MHz	I <sub>F</sub> = 100mA f = 100MHz	I <sub>F</sub> = 1mA f = 100MHz

Note : R<sub>s</sub> parameters are tested under AQL 1.0

## Typical Performance, Tc = +25°C (Each Diode)

	Carrier Lifetime τ(ns)	Reverse Recovery Time T <sub>rr</sub> (ns)	Total Capacitance C <sub>T</sub> (pF)
	1500	300	0.27
Test Condition	I <sub>F</sub> = 50mA I <sub>R</sub> = 250 mA	V <sub>R</sub> = 10V I <sub>F</sub> = 20 mA 90% Recovery	V <sub>R</sub> = 50V f = 1MHz

## Typical Performance for HSMP-3816 Quad PIN Diode π Attenuator @ +25°C

Parameter	Test Condition	Units	Typical
Insertion Loss	V <sub>c</sub> = 15V, V <sub>+</sub> = 5V, Freq = 1GHz	dB	-3.0
Return Loss	V <sub>c</sub> = 0V, V <sub>+</sub> = 5V, Freq = 1GHz	dB	-22
Attenuation	V <sub>c</sub> = 0V, V <sub>+</sub> = 5V, Freq = 1GHz	dB	38
Input IP3	V <sub>c</sub> = 1.5V, V <sub>+</sub> = 5V, Freq = 1GHz	dBm	45
Input IP3	V <sub>c</sub> = 15V, V <sub>+</sub> = 5V, Freq = 1GHz	dBm	42
Input IP3	V <sub>c</sub> = 1.5V, V <sub>+</sub> = 5V, Freq = 100MHz	dBm	37
Input IP3	V <sub>c</sub> = 15V, V <sub>+</sub> = 5V, Freq = 100MHz	dBm	37
Input IP3	V <sub>c</sub> = 1.5V, V <sub>+</sub> = 5V, Freq = 30MHz	dBm	35
Input IP3	V <sub>c</sub> = 15V, V <sub>+</sub> = 5V, Freq = 30MHz	dBm	35

Notes :

1. Measurement above obtained using Wideband RF circuit design shown in Figure 1 & 2

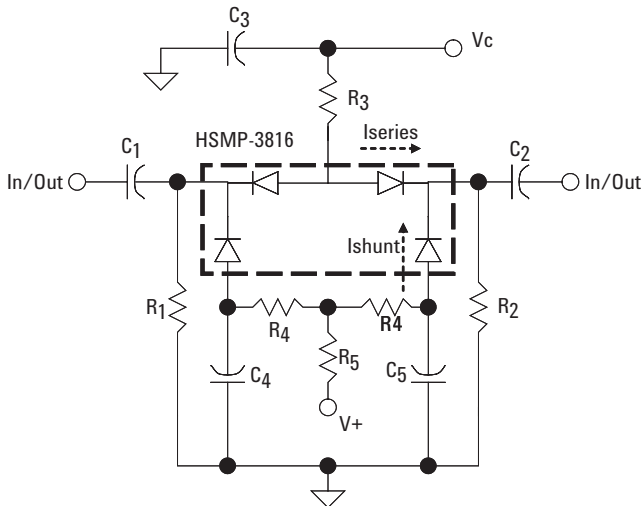


Figure 1. Wideband Quad PIN Diode  $\pi$  Attenuator Circuit

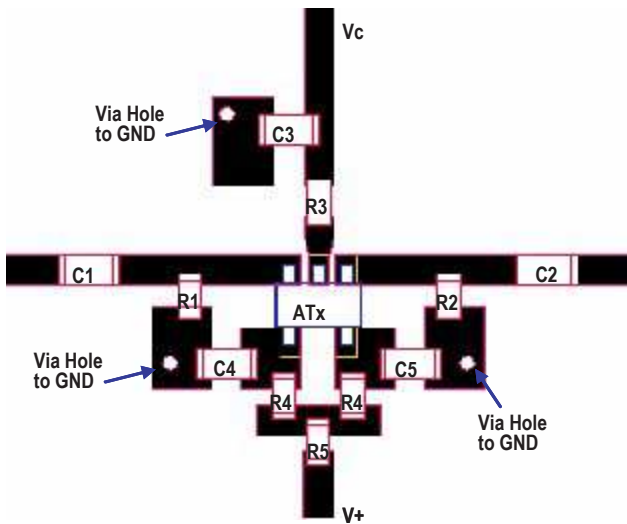


Figure 2. Circuit Board Layout

Component	Value
R1,R2	560 Ohm
R3	330 Ohm
R4	1500 Ohm
R5	680 Ohm
C1-C5	47000 pF

Typical Performance Curves for Single Diode @  $T_c = +25^\circ\text{C}$ ,

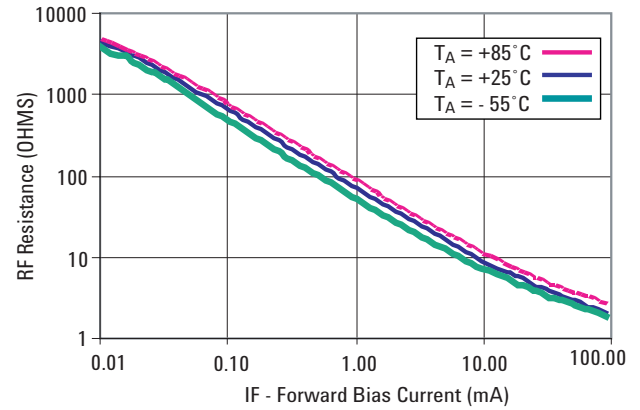


Figure 3. RF Resistance vs. Forward Bias Current

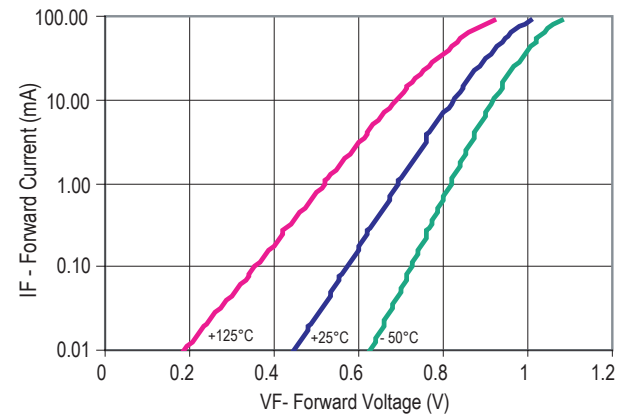


Figure 4. Forward Current vs. Forward Voltage

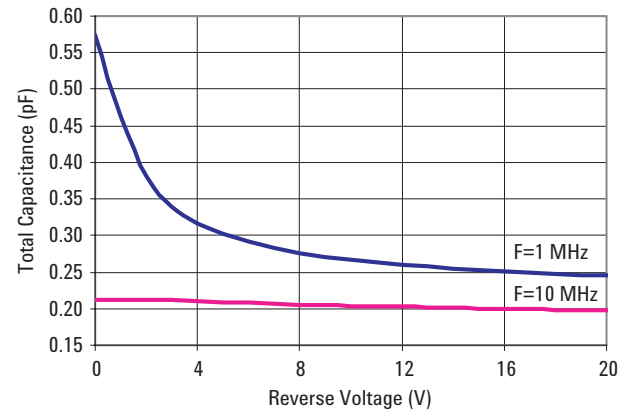
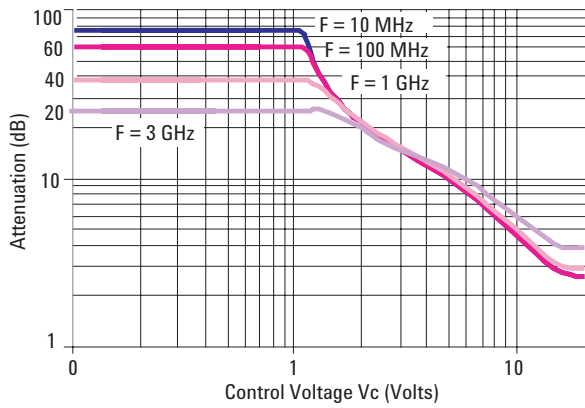


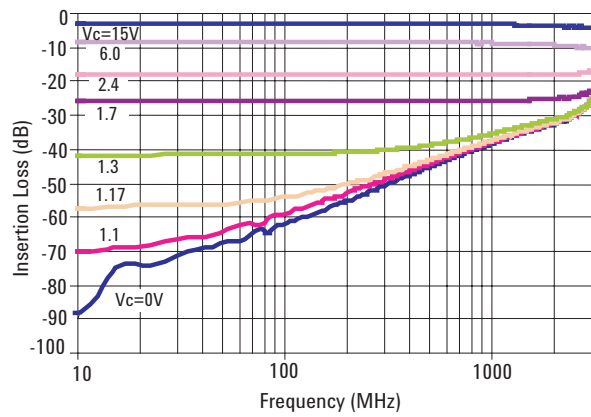
Figure 5. RF Capacitance vs Reverse Bias



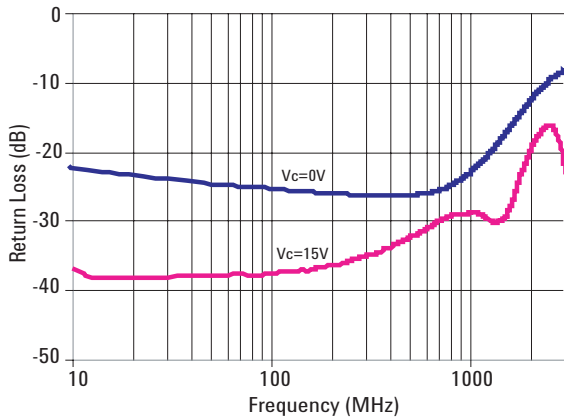
**Typical Performance Curves for HSMP-3816, @  $V_+ = 5V, T_c = +25^\circ C$**



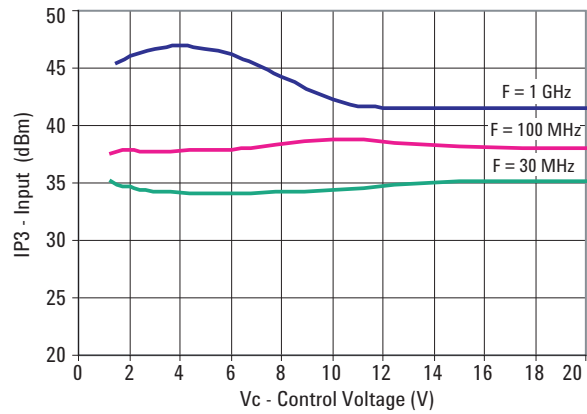
**Figure 6. Attenuation vs. Control Voltage**



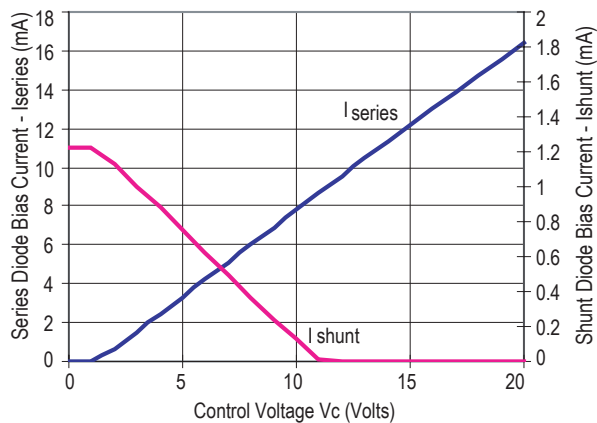
**Figure 7. Insertion Loss vs. Frequency**



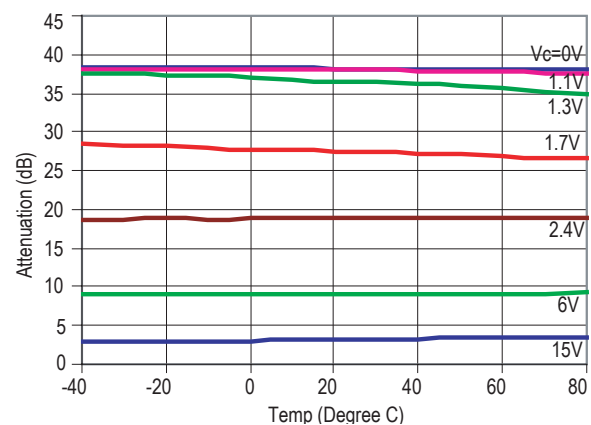
**Figure 8. Return Loss vs. Frequency**



**Figure 9. Input IIP3 vs. Control Voltage**



**Figure 10. Series & Shunt Diode Bias Current vs. Control Voltage**

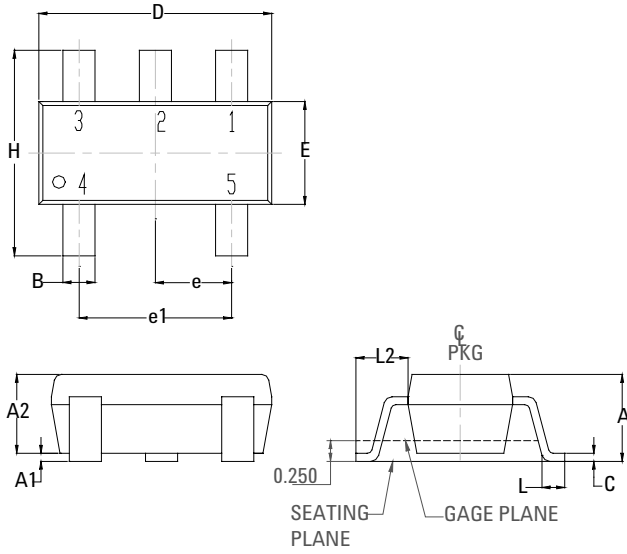


**Figure 11. Attenuation vs. Temperature**

Note:

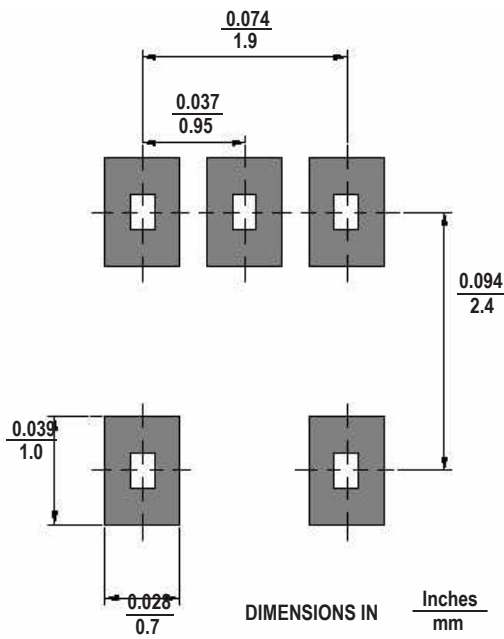
1. Measurements above were obtained using Wideband RF circuit design shown in Figures 1 and 2.
2. Typical values were derived using limited samples during initial product characterization and may not be representative of the overall distribution.

## Package Outline & Dimension

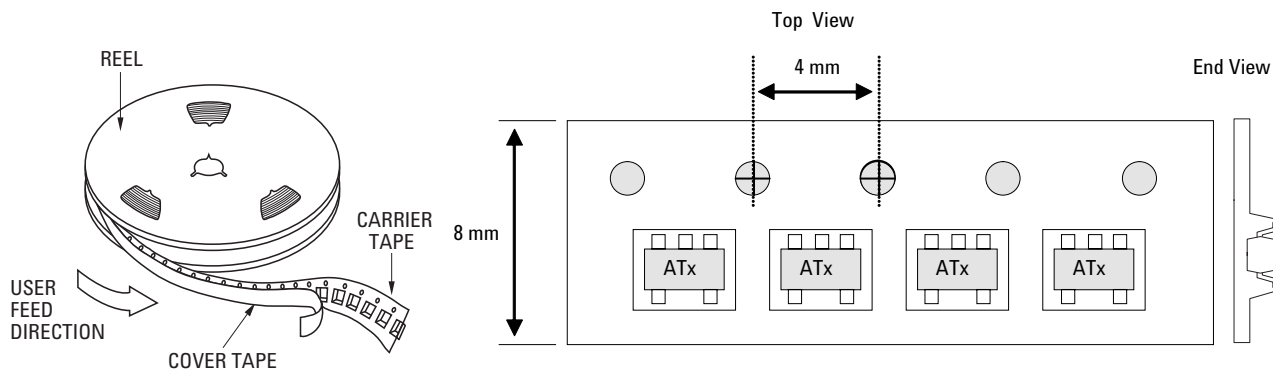


Symbol	Dimension		
	Minimum	Nominal	Maximum
D	2.80	2.90	3.00
H	2.60	2.80	3.00
E	1.50	1.60	1.70
e1	1.88	1.90	1.92
e	0.93	0.95	0.97
B	0.35		0.50
A2	0.9	1.15	1.30
C	0.08		0.22
L	0.35		0.60
A1	0		0.15
A	0.9		1.40

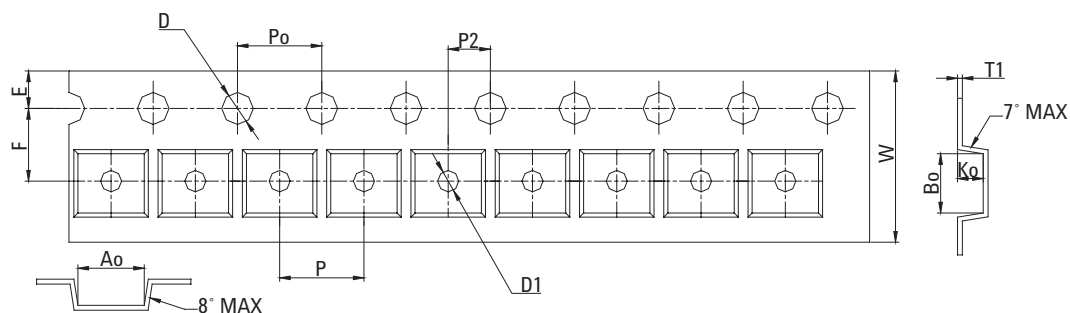
## PCB Footprint



## Device Orientation



## Tape Dimension



Symbol	Millimeters		
	Nominal	Minimum	Maximum
V	8.00 (0.315)	7.90 (0.311)	8.30 (0.327)
P	4.00 (0.157)	3.90 (0.154)	4.10 (0.161)
E	1.75 (0.069)	1.65 (0.065)	1.85 (0.073)
F	3.50 (0.138)	3.45 (0.136)	3.55 (0.140)
J	1.50 (0.059)	N/A	1.60 (0.063)
J1	1.00 (0.039)	N/A	1.25 (0.049)
Po	4.00 (0.157)	3.90 (0.154)	4.10 (0.161)
P2	2.00 (0.079)	1.95 (0.077)	2.05 (0.081)
Ao	3.23 (0.127)	3.13 (0.123)	3.33 (0.131)
Jo	3.81 (0.125)	3.08 (0.121)	3.28 (0.129)
Fo	1.60 (0.063)	1.50 (0.059)	1.70 (0.067)
T1	0.257 (0.0100)	0.241 (0.0095)	0.267 (0.0105)

## Part Number Ordering Information

Part number	No. of Units	Container
HSMP-3816-BLKG	100	Anti-static bag
HSMP-3816-TR1G	3000	7" reel
HSMP-3816-TR2G	10000	13" reel

For product information and a complete list of distributors, please go to our web site:

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