



## Features

- Four, six and eight channels of EMI filtering with integrated ESD protection
- Pi-style EMI filters in a capacitor-resistor-capacitor (C-R-C) network
- $\pm 15\text{kV}$  ESD protection on each channel (IEC 61000-4-2 Level 4, contact discharge)
- $\pm 30\text{kV}$  ESD protection on each channel (HBM)
- Greater than 30dB of attenuation from 800MHz to 3GHz
- UDFN package with 0.40mm lead pitch:
  - 4-ch. = 8-lead UDFN
  - 6-ch. = 12-lead UDFN
  - 8-ch. = 16-lead UDFN
- Tiny UDFN package size:
  - 8-lead: 1.7mm x 1.35mm x 0.50mm
  - 12-lead: 2.5mm x 1.35mm x 0.50mm
  - 16-lead: 3.3mm x 1.35mm x 0.50mm
- Increased robustness against vertical impacts during manufacturing process
- Lead-free finishing

## Applications

- I/O port protection for mobile handsets, notebook computers, PDAs etc.
- EMI filtering for data ports in cell phones, PDAs or notebook computers.
- EMI filtering for LCD, camera and chip-to-chip data lines

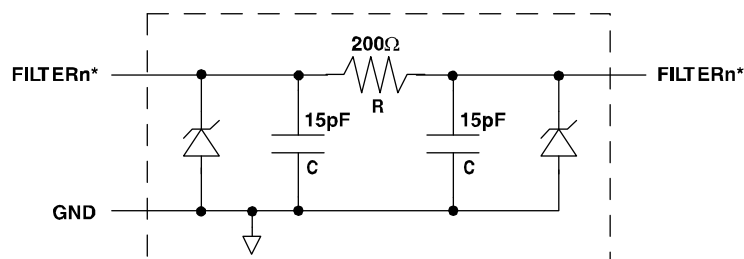
## Product Description

The CM1636 is an EMI filter array with ESD protection, which integrates either four, six or eight pi filters (C-R-C). Each CM1636 filter has component values of 15pF-200W-15pF. These parts include ESD protection diodes on every pin, providing a very high level of protection for sensitive electronic components that may be subjected to electrostatic discharge (ESD). The ESD diodes connected to the filter ports safely dissipate ESD strikes of  $\pm 15\text{kV}$  contact discharge, twice the specification requirement of the IEC 61000-4-2, Level 4 international standard. Using the MIL-STD-883 (Method 3015) specification for Human Body Model (HBM) ESD, the pins are protected for contact discharges at greater than  $\pm 30\text{kV}$ .

This device is particularly well-suited for portable electronics (e.g. mobile handsets, PDAs, notebook computers) because of its small package and easy-to-use pin assignments. In particular, the CM1636 is ideal for EMI filtering and protecting data lines from ESD in wireless handsets.

The CM1636 is available in space-saving, ultra-low-profile, 8-lead, 12-lead and 16-lead 0.4mm pitch UDFN packages. It is fabricated with California Micro Devices' Centurion™ process and available with lead-free finishing.

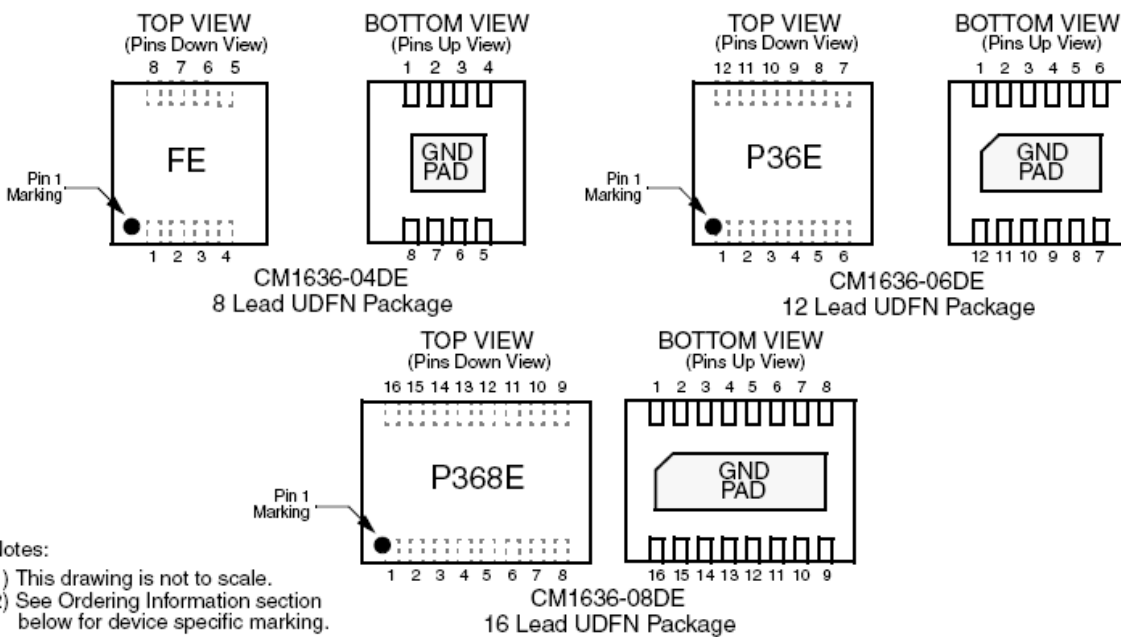
## Electrical Schematic



1 of 4/6/8 EMI Filtering + ESD Channels

\* See Package/Pinout Diagram for expanded pin information.

## PACKAGE / PINOUT DIAGRAMS



## PIN DESCRIPTIONS

Pins			NAME	DESCRIPTION	Pins			NAME	DESCRIPTION
1636-04Dx	1636-06Dx	1636-08Dx			1636-04Dx	1636-06Dx	1636-08Dx		
1	1	1	FILTER1	Filter Channel 1	8	12	16	FILTER1	Filter Channel 1
2	2	2	FILTER2	Filter Channel 2	7	11	15	FILTER2	Filter Channel 2
3	3	3	FILTER3	Filter Channel 3	6	10	14	FILTER3	Filter Channel 3
4	4	4	FILTER4	Filter Channel 4	5	9	13	FILTER4	Filter Channel 4
	5	5	FILTER5	Filter Channel 5		8	12	FILTER5	Filter Channel 5
	6	6	FILTER6	Filter Channel 6		7	11	FILTER6	Filter Channel 6
		7	FILTER7	Filter Channel 7			10	FILTER7	Filter Channel 7
		8	FILTER8	Filter Channel 8			9	FILTER8	Filter Channel 8
GND Pad			GND	Device Ground					

## Ordering Information

## PART NUMBERING INFORMATION

Leads/Pins	Package	Lead-free Finish	
		Ordering Part Number <sup>1</sup>	Part Marking
8	UDFN-08	CM1636-04DE	FE
12	UDFN-12	CM1636-06DE	P36E
16	UDFN-16	CM1636-08DE	P368E

Note 1: Parts are shipped in Tape & Reel form unless otherwise specified.

## Specifications

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNITS
Storage Temperature Range	-65 to +150	°C
DC Power per Resistor	100	mW
Package DC Power Rating	300	mW

### STANDARD OPERATING CONDITIONS

PARAMETER	RATING	UNITS
Operating Temperature Range	-40 to +85	°C

**ELECTRICAL OPERATING CHARACTERISTICS** (SEE NOTE 1)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
R	Resistance		160	200	240	$\Omega$
C <sub>TOTAL</sub>	Total Channel Capacitance	At 2.5VDC Reverse Bias, 1MHz, 30mVAC	24	30	36	pF
C	Capacitance	At 2.5V DC, 1MHz, 30mV AC		15		pF
V <sub>DIODE</sub>	Diode Standoff Voltage	I <sub>DIODE</sub> = 10 $\mu$ A		6.0		V
I <sub>LEAK</sub>	Diode Leakage Current (reverse bias)	V <sub>DIODE</sub> = 3.3V		0.1	1	$\mu$ A
V <sub>SIG</sub>	Signal Voltage Positive Clamp Negative Clamp	I <sub>LOAD</sub> = 10mA I <sub>LOAD</sub> = -10mA	5.6 -0.4	6.8 -0.8		V V
V <sub>ESD</sub>	In-system ESD Withstand Voltage a) Human Body Model, MIL-STD-883, Method 3015 b) Contact Discharge per IEC 61000-4-2 Level 4	Notes 2	$\pm 30$ $\pm 15$			kV kV
f <sub>c</sub>	Cut-off Frequency Z <sub>SOURCE</sub> =50 $\Omega$ , Z <sub>LOAD</sub> =50 $\Omega$	R = 200 $\Omega$ , C = 15pF; Note 3		100		MHz
A <sub>1GHz</sub>	Absolute Attenuation @ 1GHz from 0dB Level	Z <sub>SOURCE</sub> = 50 $\Omega$ , Z <sub>LOAD</sub> = 50 $\Omega$ , DC Bias = 0V; Notes 1 and 3		35		dB
A <sub>800MHz - 6GHz</sub>	Absolute Attenuation @ 800MHz to 6GHz from 0dB Level	Z <sub>SOURCE</sub> = 50 $\Omega$ , Z <sub>LOAD</sub> = 50 $\Omega$ , DC Bias = 0V; Notes 1 and 35		30		dB

Note 1: T<sub>A</sub>=25°C unless otherwise specified.

Note 2: ESD applied to input and output pins with respect to GND, one at a time.

Note 3: Attenuation / RF curves characterized by a network analyzer using microprobes.

## Performance Information

Typical Filter Performance ( $T_A=25^\circ\text{C}$ , DC Bias=0V, 50 Ohm Environment)

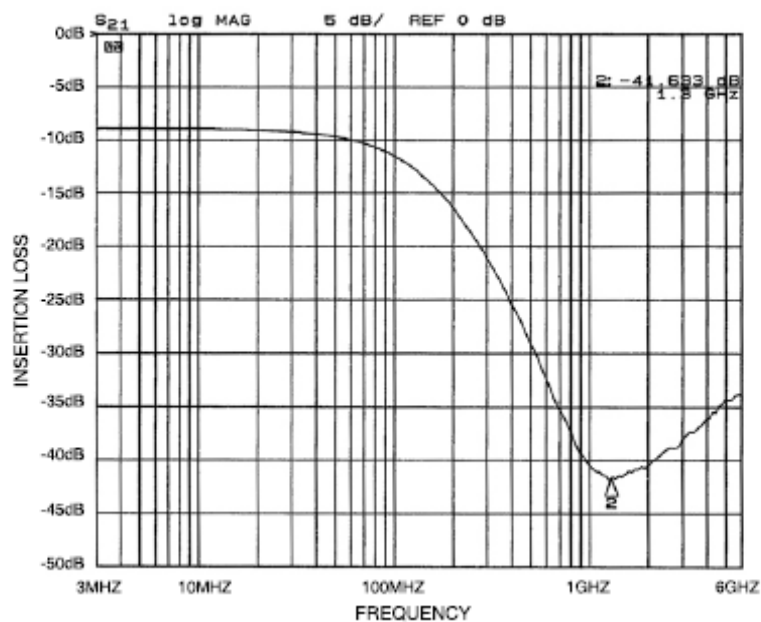


Figure 1. Insertion Loss vs. Frequency (FILTER1 Input to GND, CM1636-04DE)

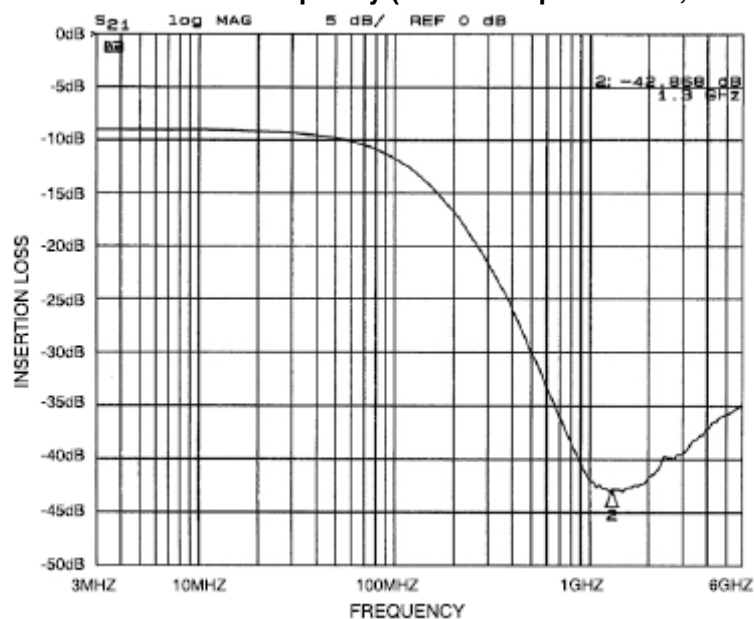


Figure 2. Insertion Loss vs. Frequency (FILTER2 Input to GND, CM1636-04DE)

## Performance Information (cont'd)

Typical Filter Performance ( $T_A=25^\circ\text{C}$ , DC Bias=0V, 50 Ohm Environment)

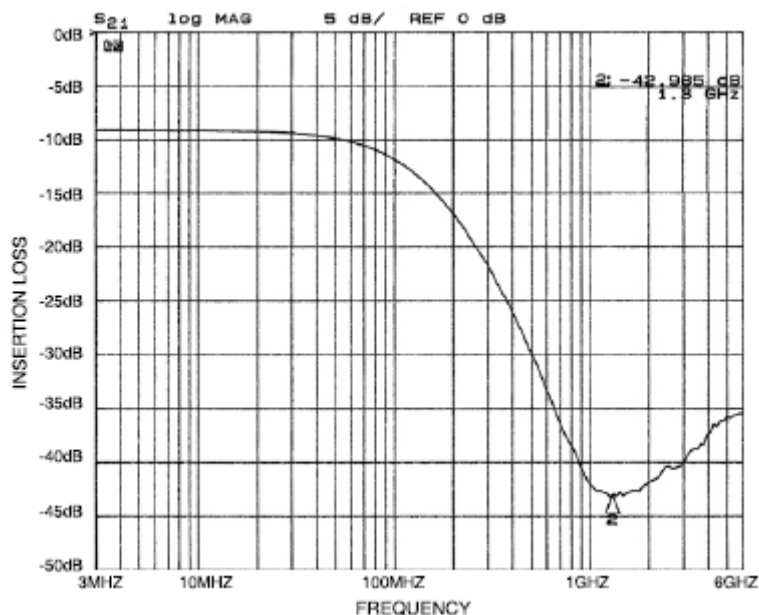


Figure 3. Insertion Loss vs. Frequency (FILTER3 Input to GND, CM1636-04DE)

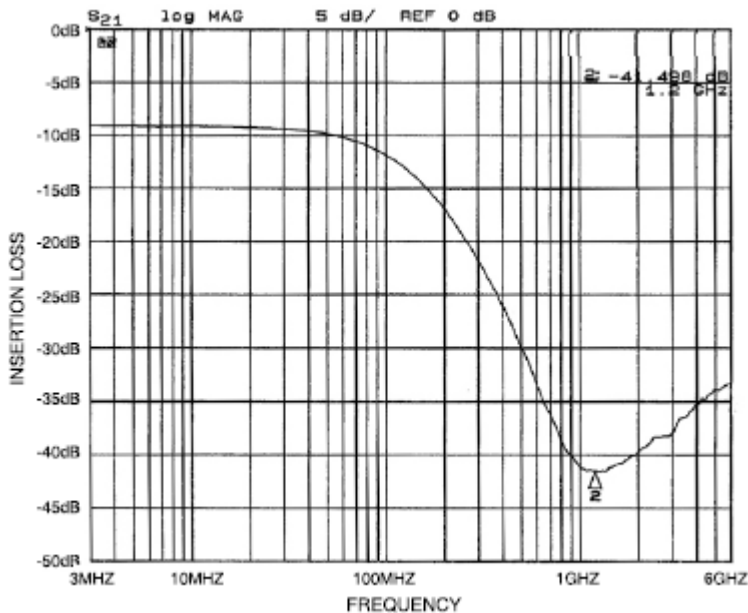


Figure 4. Insertion Loss vs. Frequency (FILTER4 Input to GND, CM1636-04DE)

## Performance Information (cont'd)

Typical Filter Performance ( $T_A=25^\circ\text{C}$ , DC Bias=0V, 50 Ohm Environment)

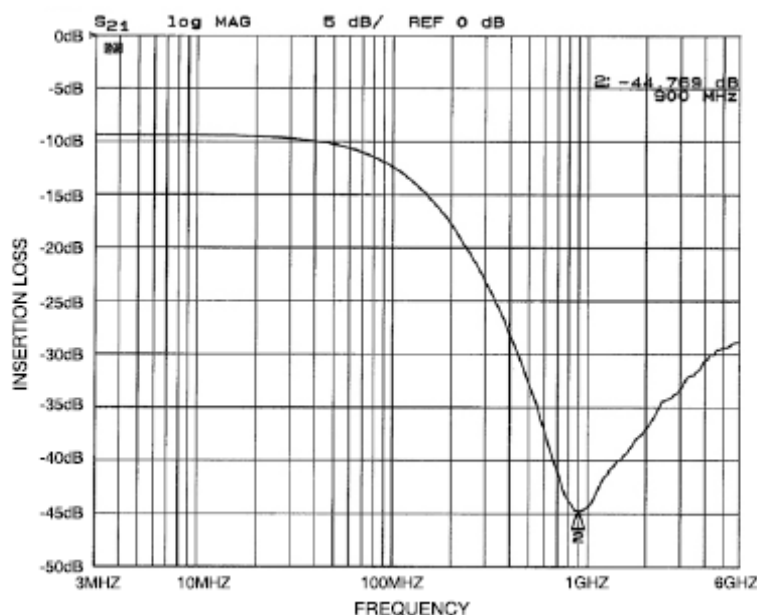


Figure 5. Insertion Loss vs. Frequency (FILTER1 Input to GND, CM1636-06DE)

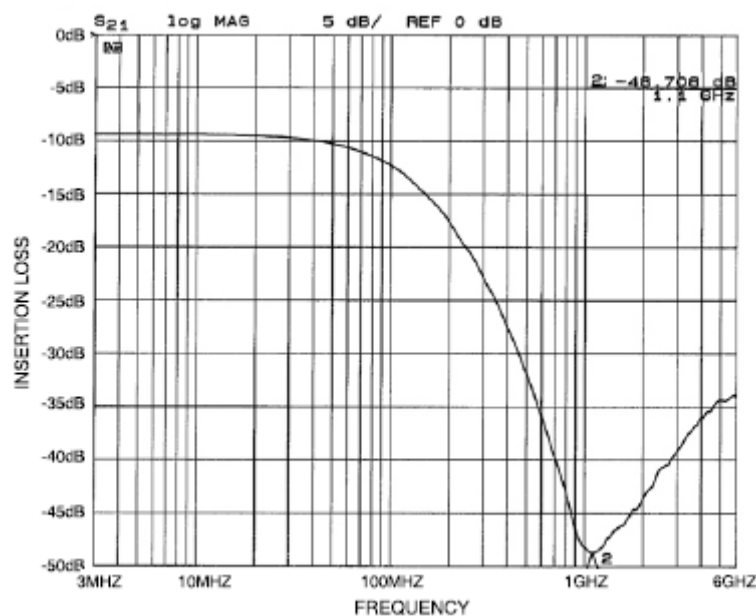


Figure 6. Insertion Loss vs. Frequency (FILTER2 Input to GND, CM1636-06DE)



## Performance Information (cont'd)

Typical Filter Performance ( $T_A=25^{\circ}\text{C}$ , DC Bias=0V, 50 Ohm Environment)

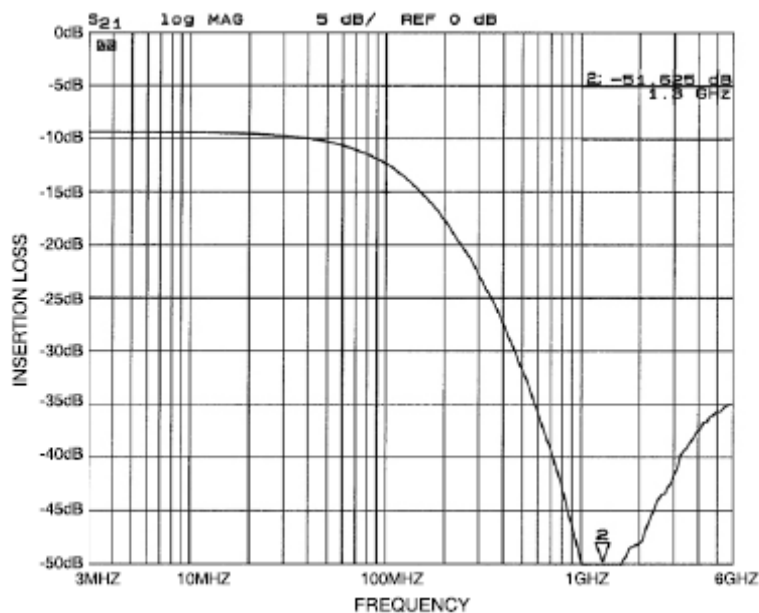


Figure 7. Insertion Loss vs. Frequency (FILTER3 Input to GND, CM1636-06DE)

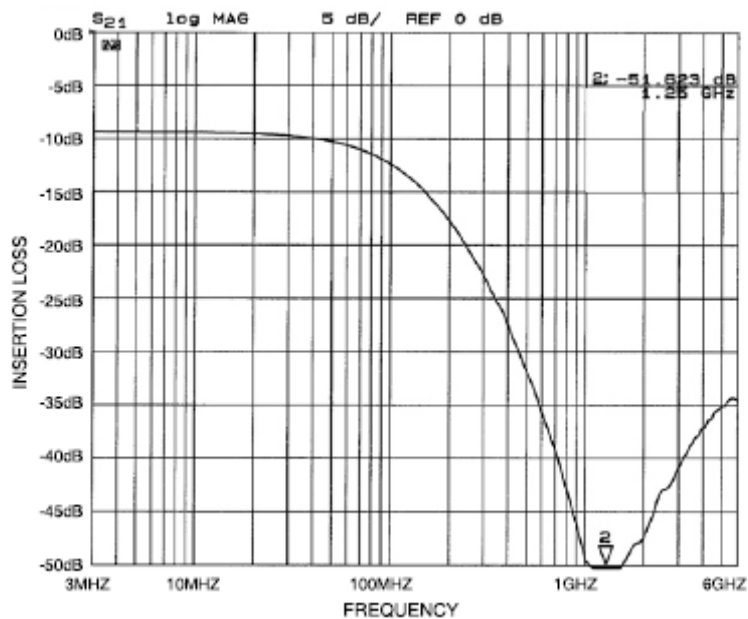


Figure 8. Insertion Loss vs. Frequency (FILTER4 Input to GND, CM1636-06DE)

## Performance Information (cont'd)

Typical Filter Performance ( $T_A=25^\circ\text{C}$ , DC Bias=0V, 50 Ohm Environment)

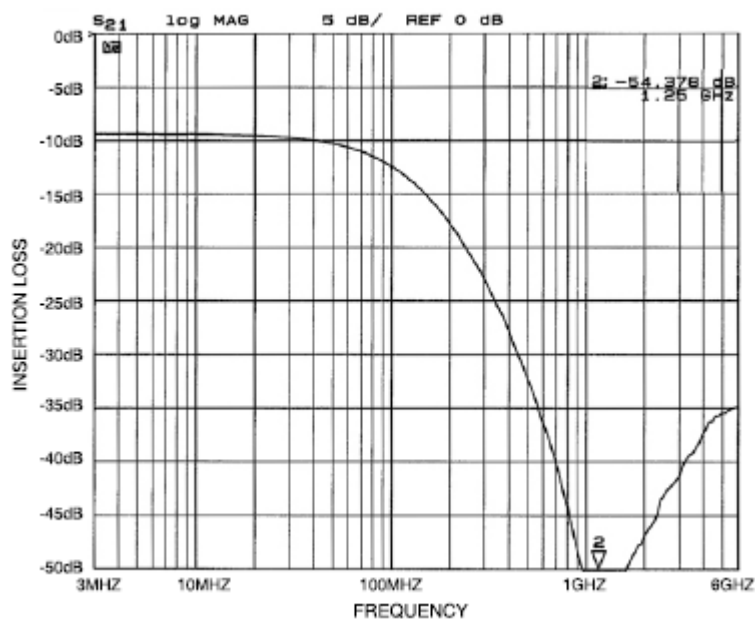


Figure 9. Insertion Loss vs. Frequency (FILTER5 Input to GND, CM1636-06DE)

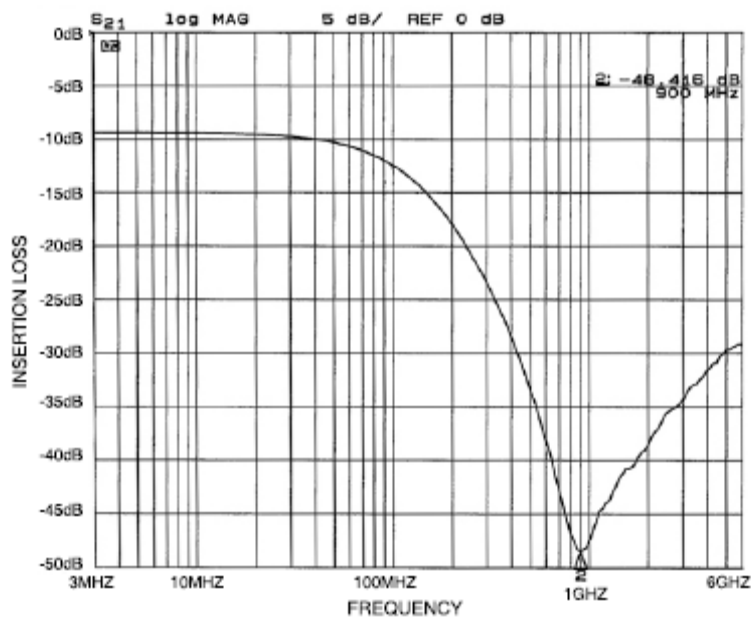


Figure 10. Insertion Loss vs. Frequency (FILTER6 Input to GND, CM1636-06DE)

## Performance Information (cont'd)

Typical Filter Performance ( $T_A=25^\circ\text{C}$ , DC Bias=0V, 50 Ohm Environment)

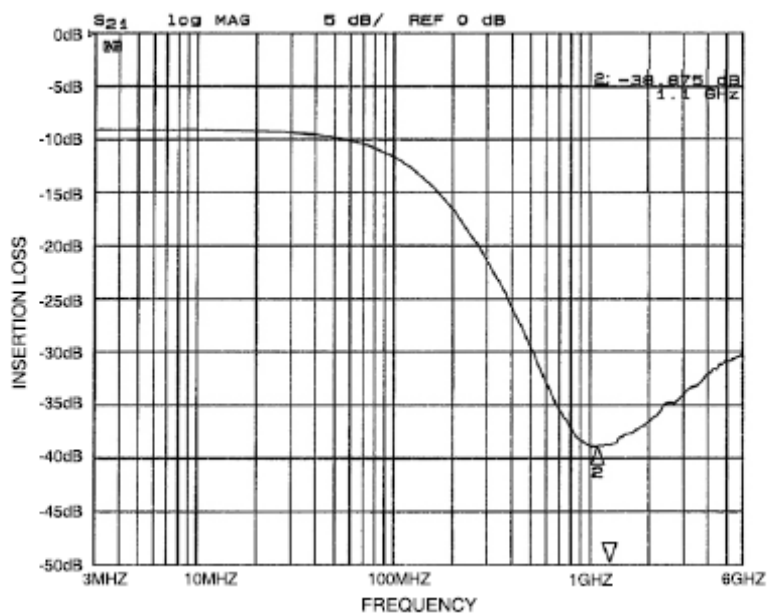


Figure 11. Insertion Loss vs. Frequency (FILTER1 Input to GND, CM1636-08DE)

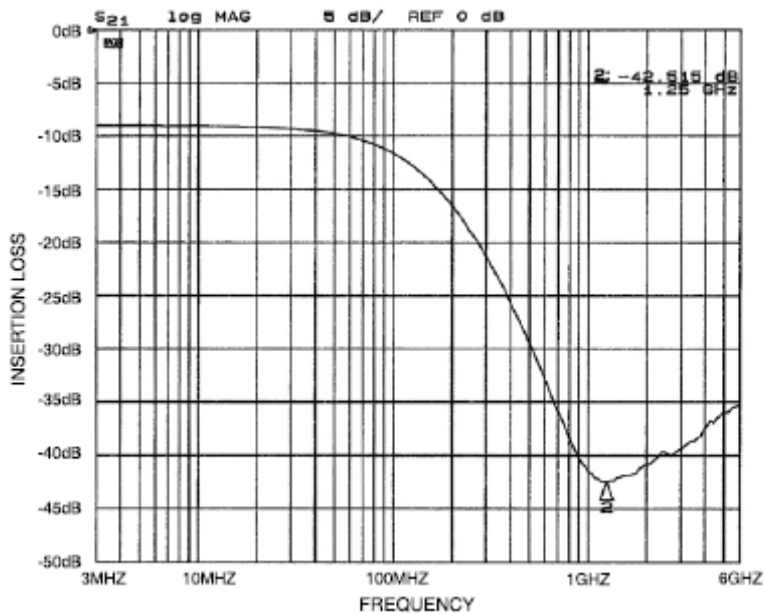


Figure 12. Insertion Loss vs. Frequency (FILTER2 Input to GND, CM1636-08DE)

## Performance Information (cont'd)

Typical Filter Performance ( $T_A=25^{\circ}\text{C}$ , DC Bias=0V, 50 Ohm Environment)

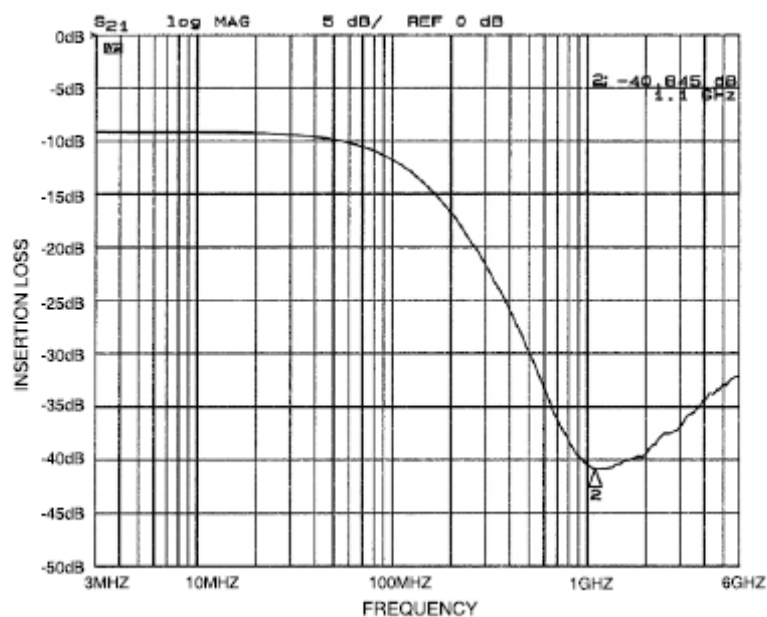


Figure 13. Insertion Loss vs. Frequency (FILTER3 Input to GND, CM1636-08DE)

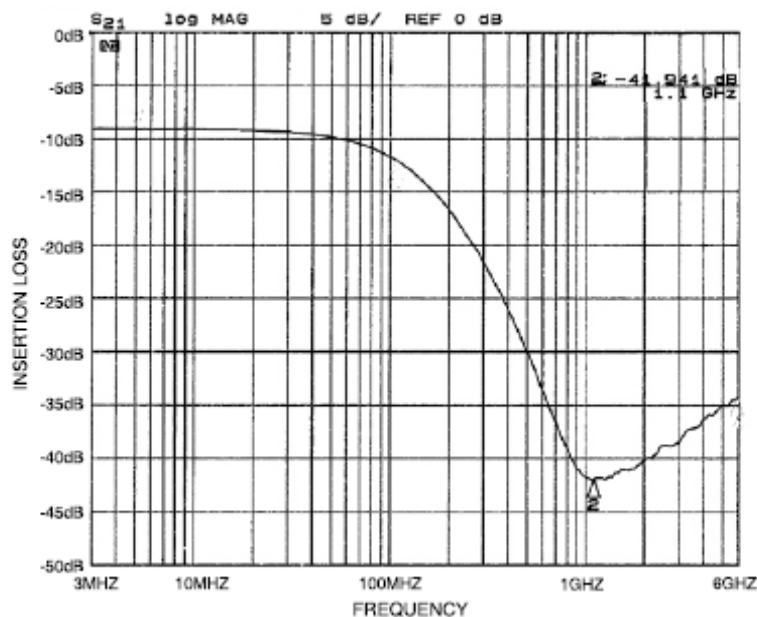


Figure 14. Insertion Loss vs. Frequency (FILTER4 Input to GND, CM1636-08DE)

## Performance Information (cont'd)

Typical Filter Performance ( $T_A=25^\circ\text{C}$ , DC Bias=0V, 50 Ohm Environment)

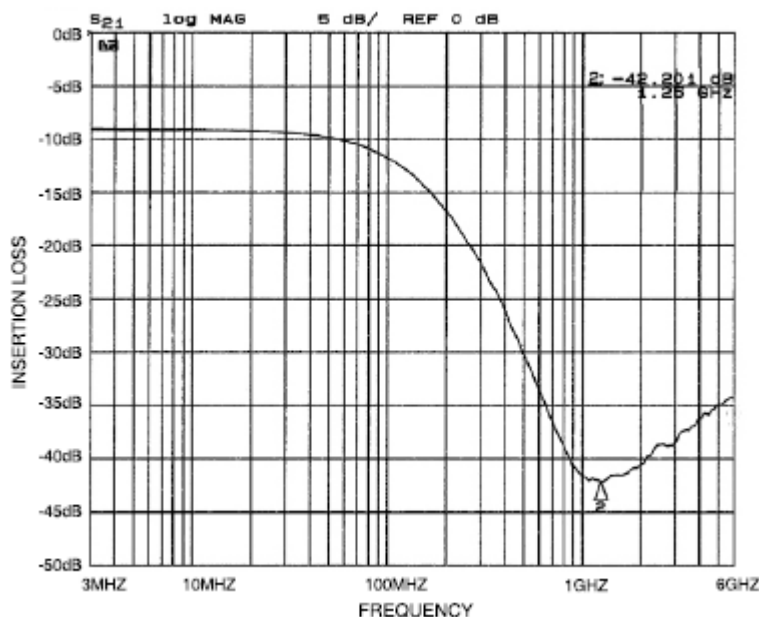


Figure 15. Insertion Loss vs. Frequency (FILTER5 Input to GND, CM1636-08DE)

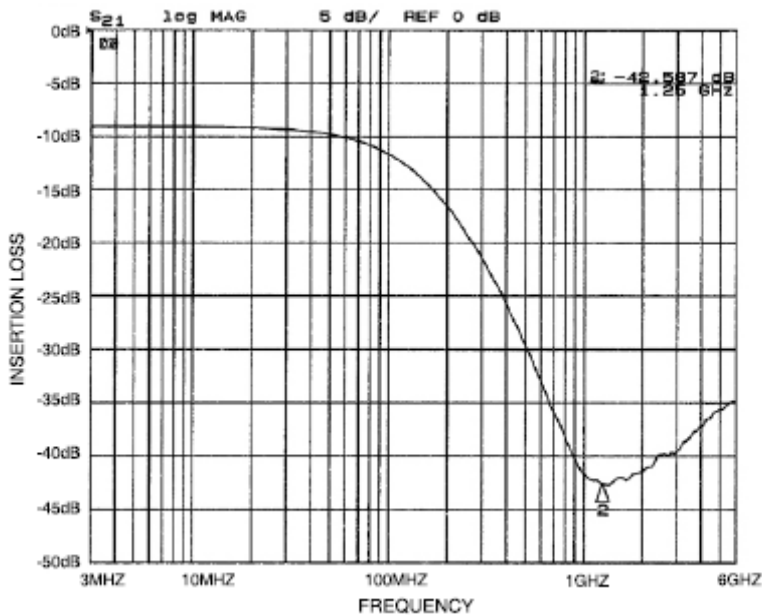


Figure 16. Insertion Loss vs. Frequency (FILTER6 Input to GND, CM1636-08DE)

## Performance Information (cont'd)

Typical Filter Performance ( $T_A=25^\circ\text{C}$ , DC Bias=0V, 50 Ohm Environment)

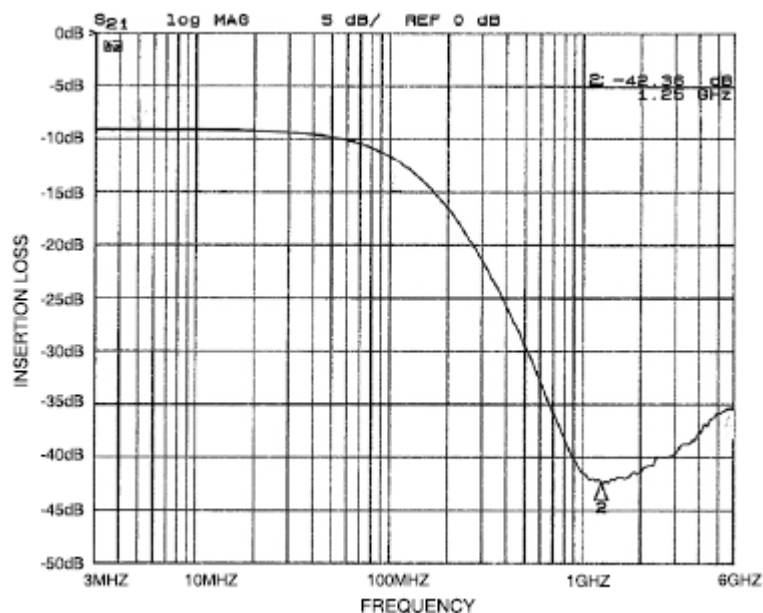


Figure 17. Insertion Loss vs. Frequency (FILTER7 Input to GND, CM1636-08DE)

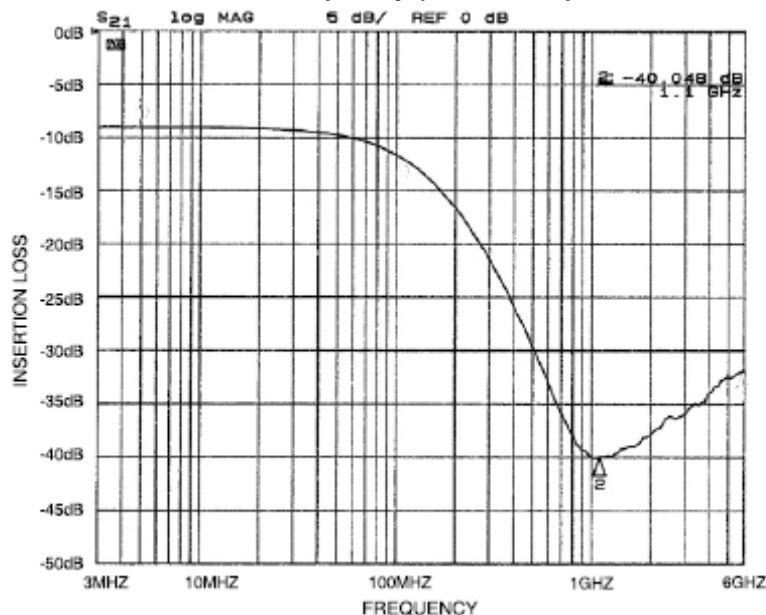
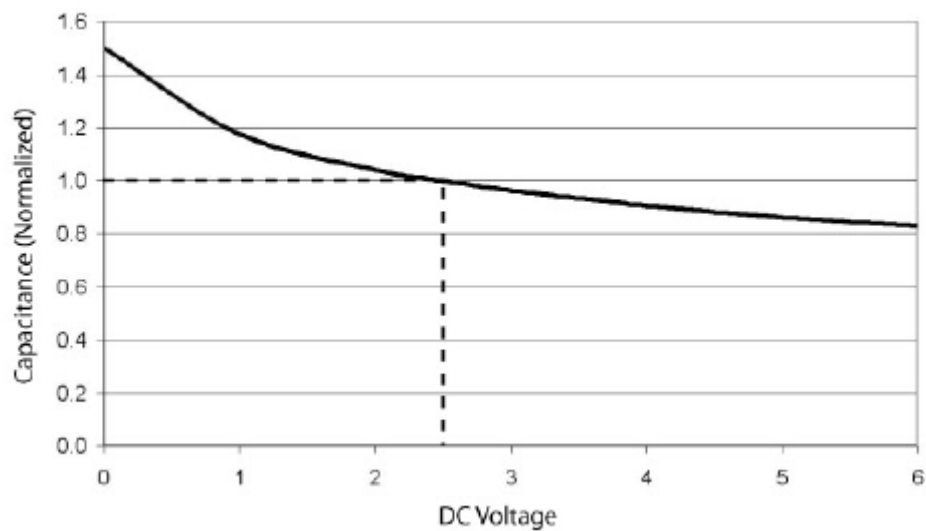


Figure 18. Insertion Loss vs. Frequency (FILTER8 Input to GND, CM1636-08DE)

**Performance Information (cont'd)**

**Figure 19. Filter Capacitance vs. Input Voltage over Temperature  
(normalized to capacitance at 2.5VDC and 25°C)**

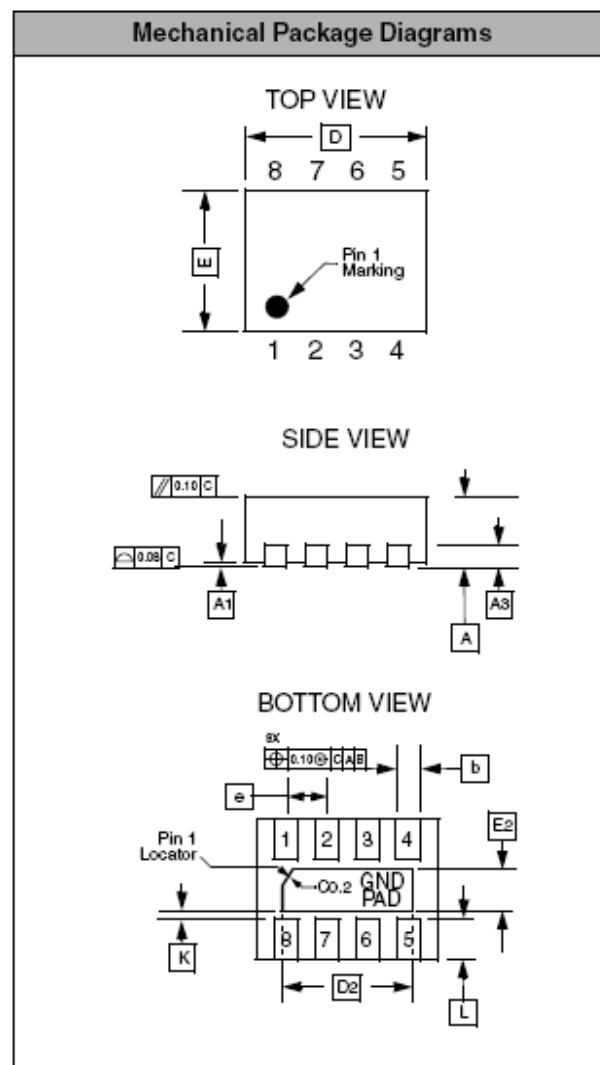
## Mechanical Details

### UDFN-08 Mechanical Specifications

Dimensions for the CM1636 supplied in a 8-lead, 0.4mm pitch UDFN package are presented below.

PACKAGE DIMENSIONS						
Package	uDFN					
JEDEC No.	MO-229C*					
Leads	8					
Dim.	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A	0.45	0.50	0.55	0.018	0.020	0.022
A1	0.00	0.02	0.05	0.000	0.001	0.002
A3	0.127 REF			0.005 REF		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	1.60	1.70	1.80	0.063	0.067	0.071
D2	1.10	1.20	1.30	0.043	0.047	0.051
E	1.25	1.35	1.45	0.049	0.053	0.057
E2	0.30	0.40	0.50	0.012	0.016	0.020
e	0.40 BSC			0.016 BSC		
K	0.22 REF			0.009 REF		
L	0.15	0.25	0.35	0.006	0.010	0.014
# per tape and reel	3000 pieces					
Controlling dimension: millimeters						

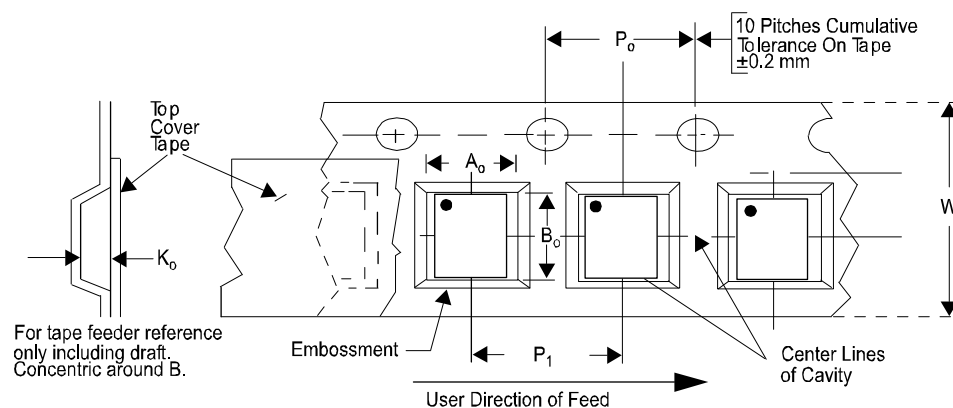
\* This package is compliant with JEDEC standard MO-229C with the exception of the D, D2, E, E2, K and L dimensions as called out in the table above.





## Tape and Reel Specifications

PART NUMBER	PACKAGE SIZE (mm)	POCKET SIZE (mm) $B_o \times A_o \times K_o$	TAPE WIDTH W	REEL DIAMETER	QTY PER REEL	$P_o$	$P_1$
CM1636-04DE	1.70 X 1.35 X 0.50	1.95 X 1.60 X 0.60	8mm	178mm (7")	3000	4mm	4mm



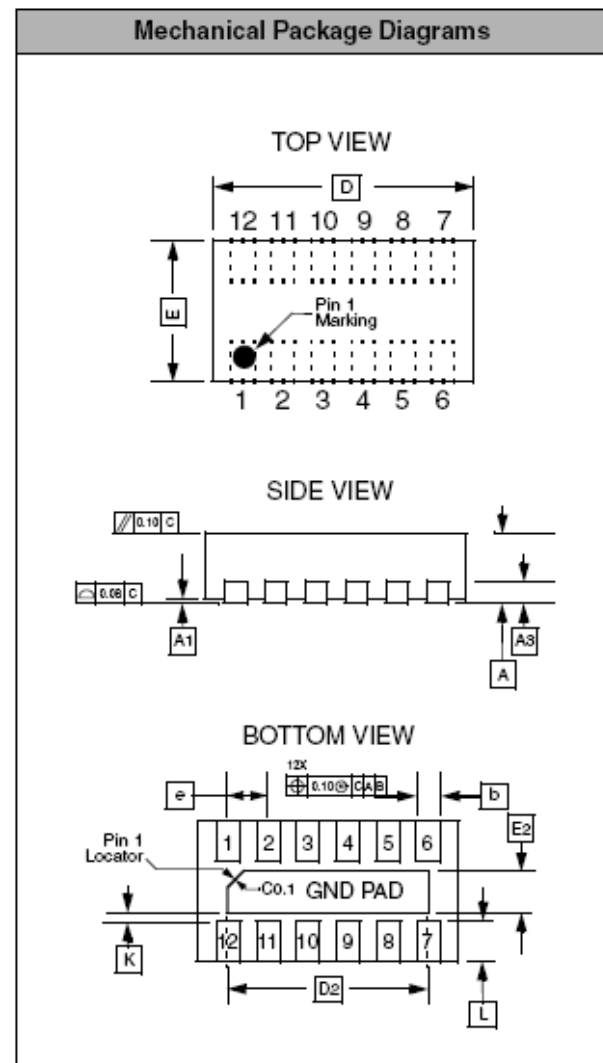
## Mechanical Details (cont'd)

### UDFN-12 Mechanical Specifications

Dimensions for the CM1636 supplied in a 12-lead, 0.4mm pitch UDFN package are presented below.

PACKAGE DIMENSIONS						
Package	uDFN					
JEDEC No.	MO-229C*					
Leads	12					
Dim.	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A	0.45	0.50	0.55	0.018	0.020	0.022
A1	0.00	0.02	0.05	0.000	0.001	0.002
A3	0.127 REF			0.005 REF		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	2.40	2.50	2.60	0.094	0.098	0.102
D2	1.90	2.00	2.10	0.075	0.079	0.083
E	1.25	1.35	1.45	0.049	0.053	0.057
E2	0.30	0.40	0.50	0.012	0.016	0.020
e	0.40 BSC			0.016 BSC		
K	0.22 REF			0.009 REF		
L	0.15	0.25	0.35	0.006	0.010	0.014
# per tape and reel	3000 pieces					
Controlling dimension: millimeters						

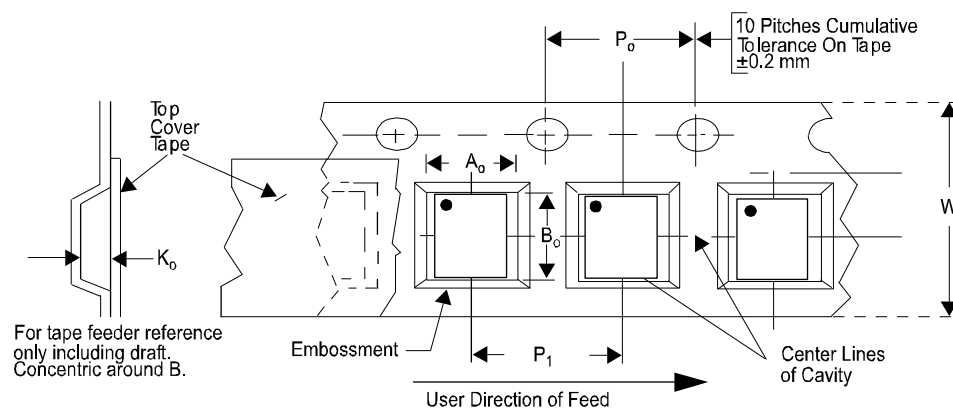
\* This package is compliant with JEDEC standard MO-229C with the exception of the D, D2, E, E2, K and L dimensions as called out in the table above.



**Dimensions for 12-Lead, 0.4mm pitch uDFN package**

## Tape and Reel Specifications

PART NUMBER	PACKAGE SIZE (mm)	POCKET SIZE (mm) $B_0 \times A_0 \times K_0$	TAPE WIDTH W	REEL DIAMETER	QTY PER REEL	$P_0$	$P_1$
CM1636-06DE	2.50 X 1.35 X 0.50	2.75 X 1.60 X 0.60	8mm	178mm (7")	3000	4mm	4mm



## Mechanical Details (cont'd)

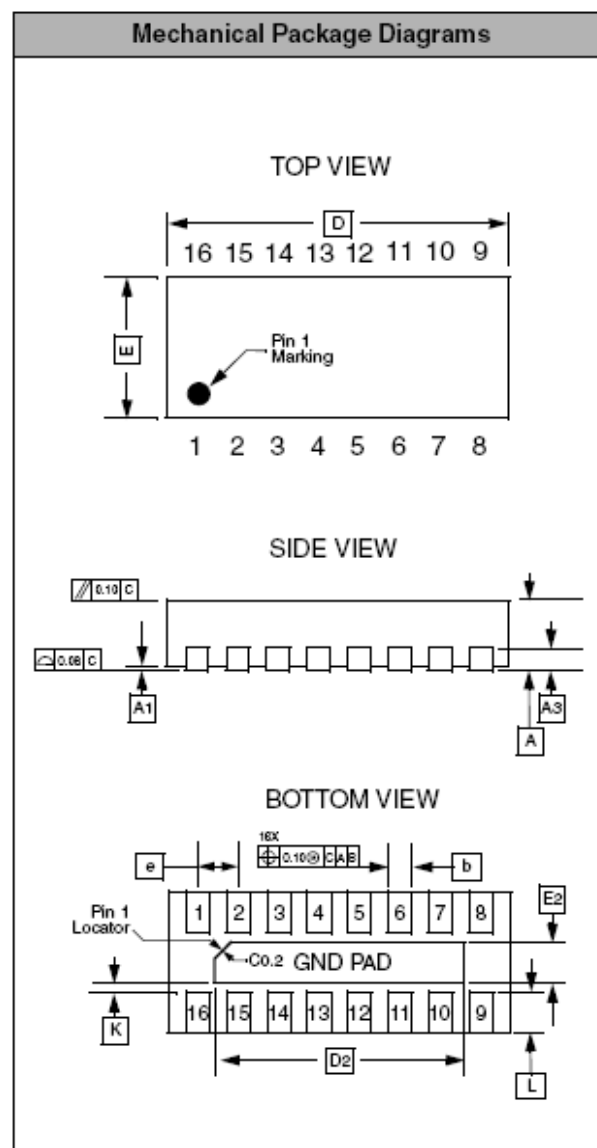
### UDFN-16 Mechanical Specifications

Dimensions for the CM1636 supplied in a 16-lead, 0.4mm pitch UDFN package are presented below.

The 16-lead, 0.4mm pitch uDFN package dimensions are presented below.

PACKAGE DIMENSIONS						
Package	uDFN					
JEDEC No.	MO-229C*					
Leads	16					
Dim.	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A	0.45	0.50	0.55	0.018	0.020	0.022
A1	0.00	0.02	0.05	0.000	0.001	0.002
A3	0.127 REF			0.005 REF		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	3.20	3.30	3.40	0.126	0.130	0.134
D2	2.70	2.80	2.90	0.106	0.110	0.114
E	1.25	1.35	1.45	0.049	0.053	0.057
E2	0.30	0.40	0.50	0.012	0.016	0.020
e	0.40 BSC			0.016 BSC		
K	0.22 REF			0.009 REF		
L	0.15	0.25	0.35	0.006	0.010	0.014
# per tape and reel	3000 pieces					
Controlling dimension: millimeters						

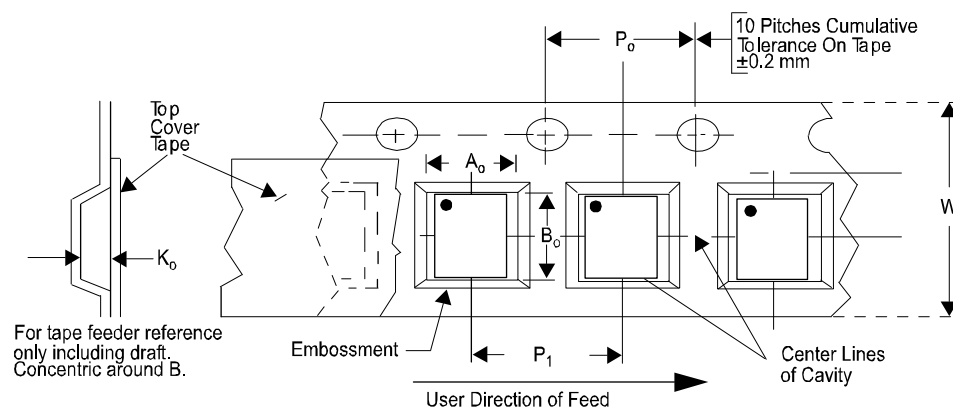
\*This package is compliant with JEDEC standard MO-229C with the exception of the D, D2, E, E2, K and L dimensions as called out in the table above.




**Dimensions for 16-Lead, 0.4mm pitch uDFN package**

## Tape and Reel Specifications

PART NUMBER	PACKAGE SIZE (mm)	POCKET SIZE (mm) $B_o \times A_o \times K_o$	TAPE WIDTH W	REEL DIAMETER	QTY PER REEL	$P_o$	$P_1$
CM1636-08DE	3.30 X 1.35 X 0.50	3.50 X 1.55 X 0.70	12mm	178mm (7")	3000	4mm	4mm



ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC 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. "Typical" parameters which may be provided in SCILLC 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. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC 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 SCILLC was negligent regarding the design or manufacture of the part. SCILLC 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  
P.O. Box 5163, Denver, Colorado 80217 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:** 81-3-5773-3850

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