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### 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

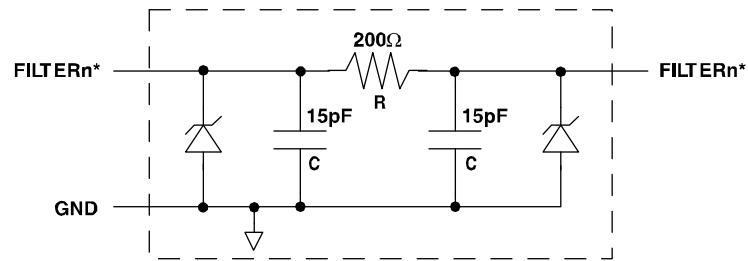
### Product Description

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*<sup>TM</sup> process and available with lead-free finishing.

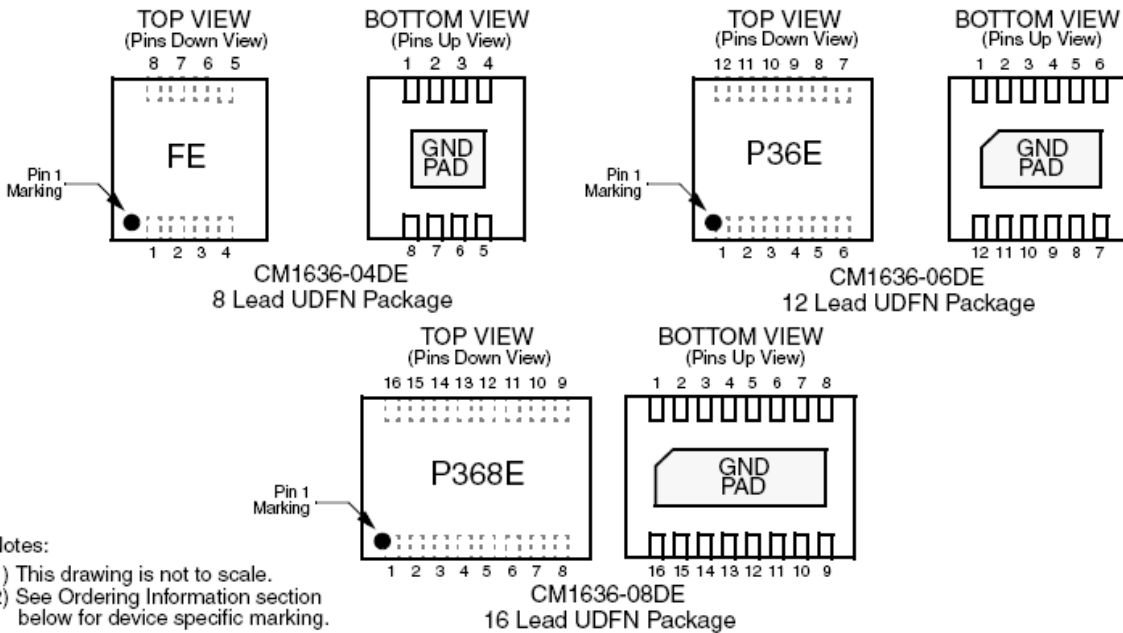
**Electrical Schematic**



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

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

**PACKAGE / PINOUT DIAGRAMS**



# CM1636

## 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)

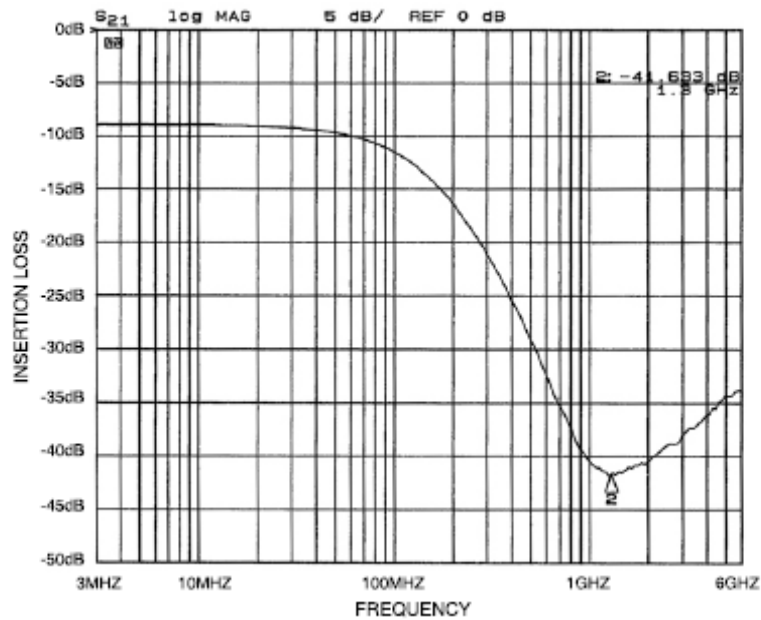


Figure 1. Insertion Loss vs. Frequency (FILTER1 Input to GND, CM1636-04DE)

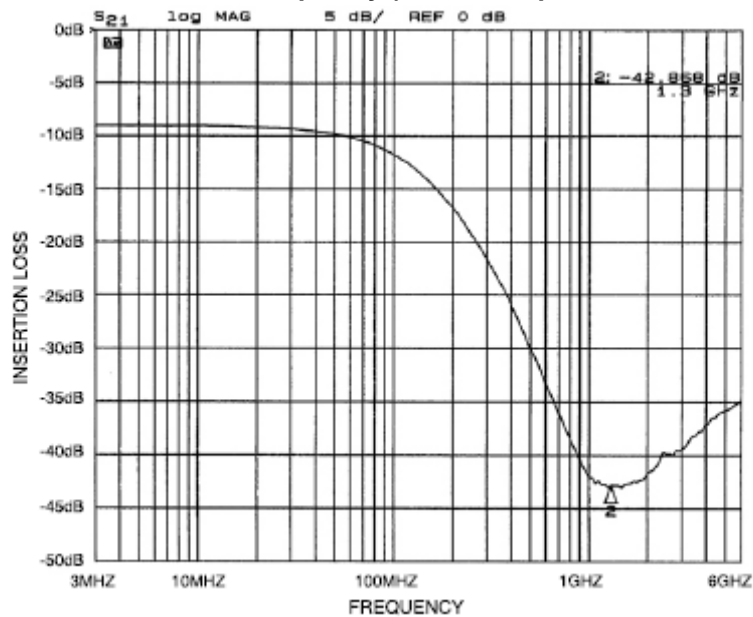


Figure 2. Insertion Loss vs. Frequency (FILTER2 Input to GND, CM1636-04DE)

Performance Information (cont'd)

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

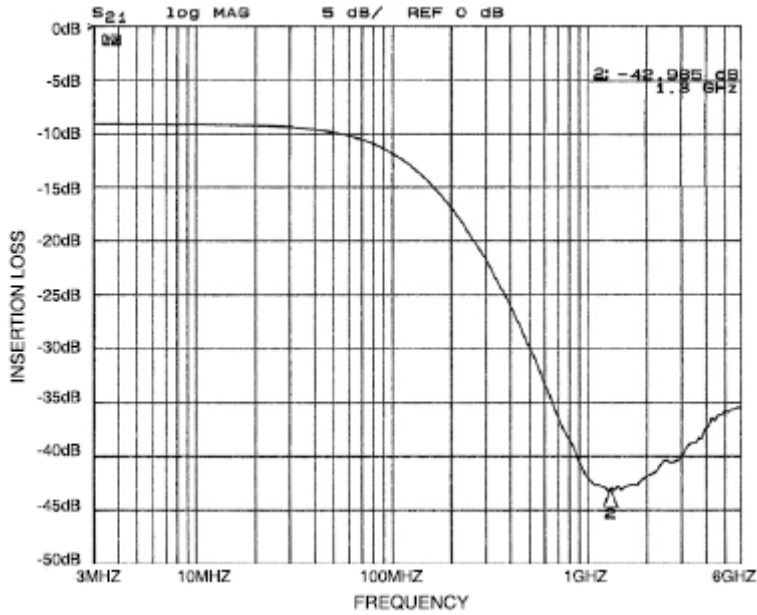


Figure 3. Insertion Loss vs. Frequency (FILTER3 Input to GND, CM1636-04DE)

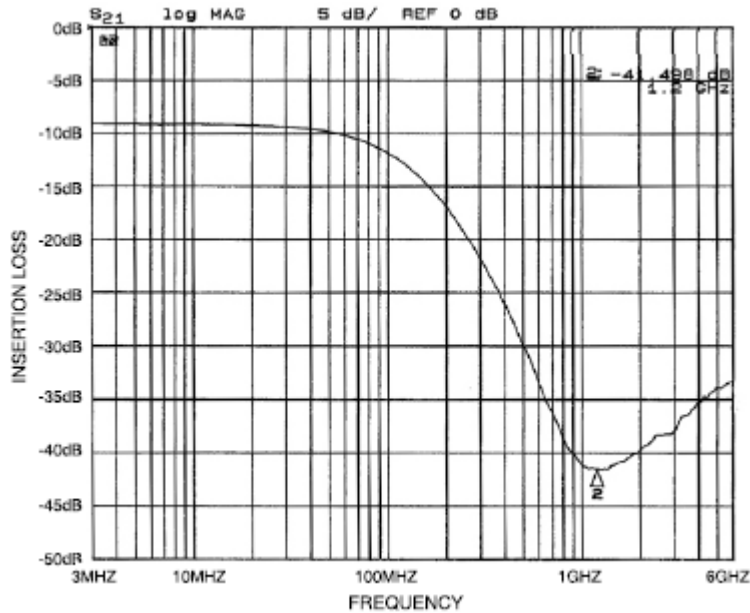


Figure 4. Insertion Loss vs. Frequency (FILTER4 Input to GND, CM1636-04DE)



## Performance Information (cont'd)

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

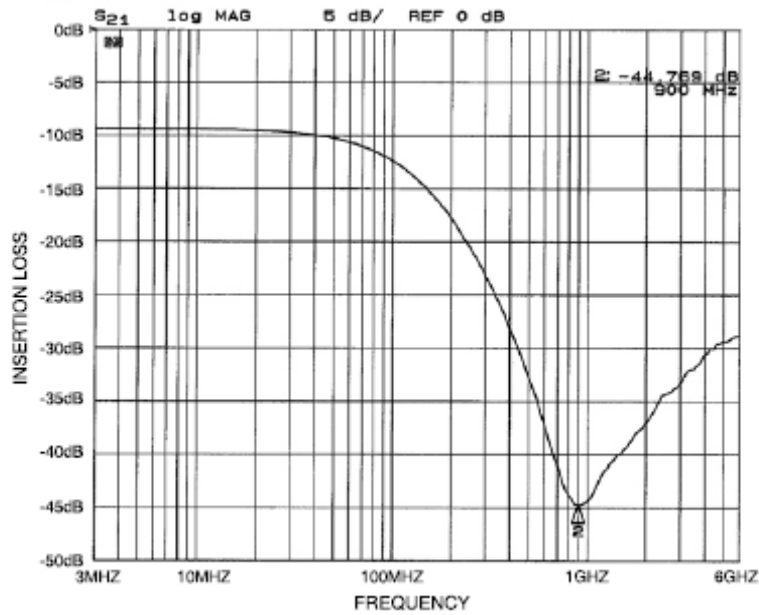


Figure 5. Insertion Loss vs. Frequency (FILTER1 Input to GND, CM1636-06DE)

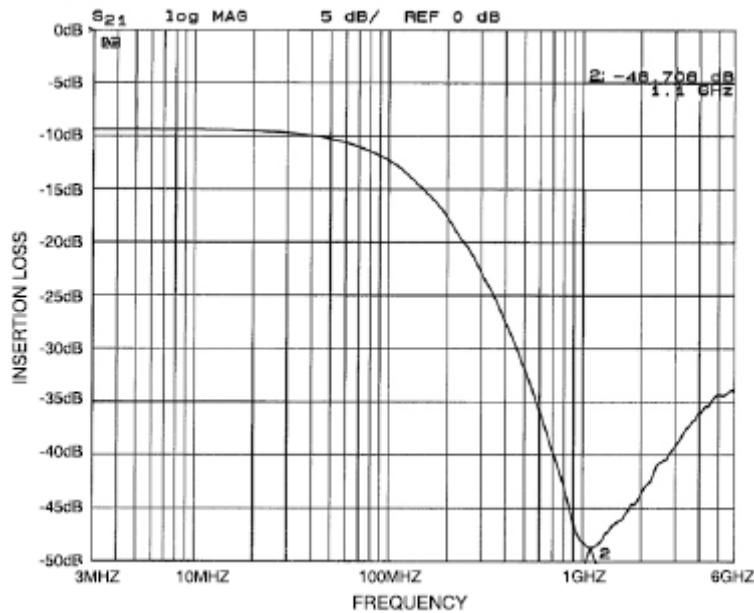


Figure 6. Insertion Loss vs. Frequency (FILTER2 Input to GND, CM1636-06DE)

Performance Information (cont'd)

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

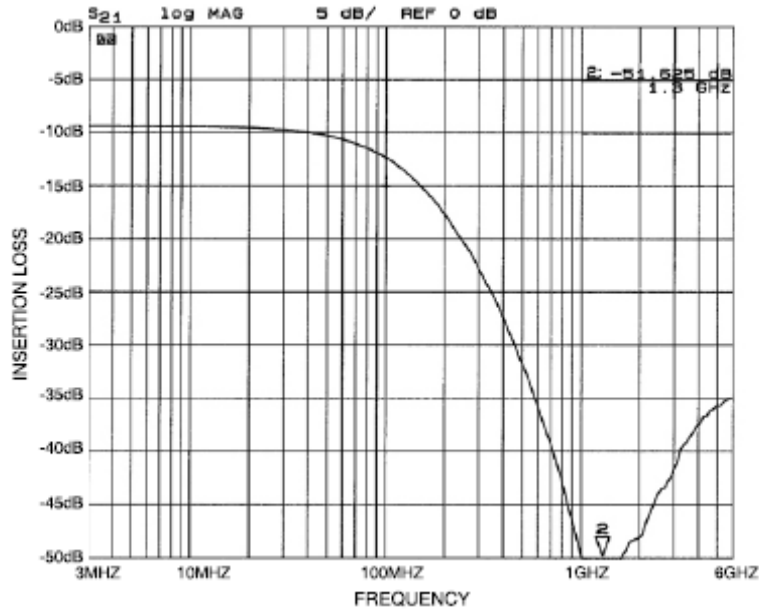


Figure 7. Insertion Loss vs. Frequency (FILTER3 Input to GND, CM1636-06DE)

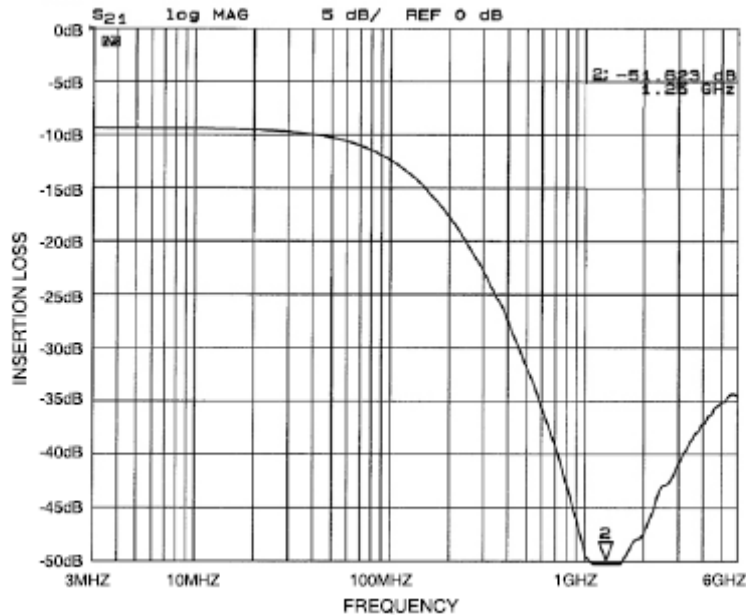


Figure 8. Insertion Loss vs. Frequency (FILTER4 Input to GND, CM1636-06DE)

## Performance Information (cont'd)

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

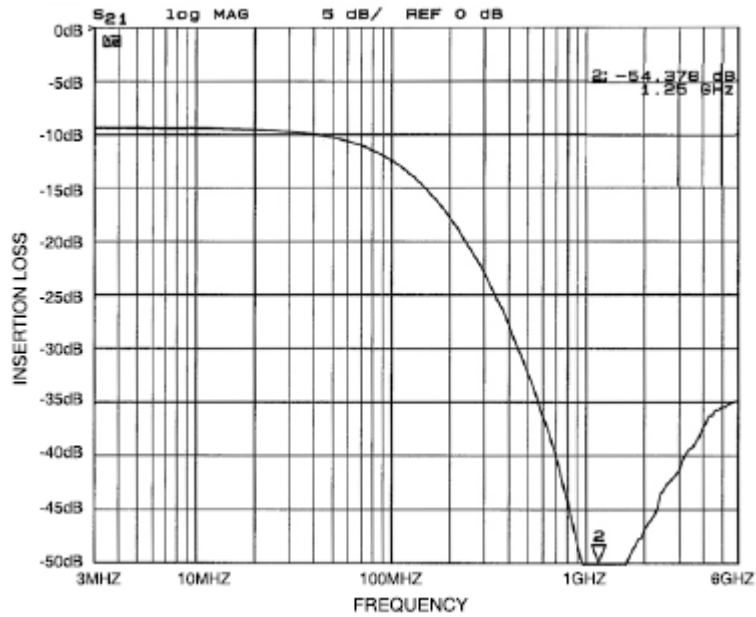


Figure 9. Insertion Loss vs. Frequency (FILTER5 Input to GND, CM1636-06DE)

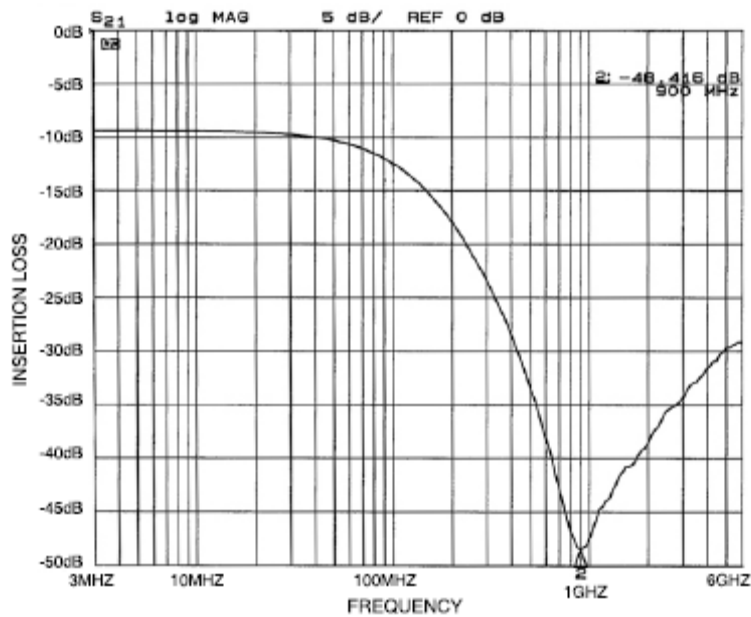


Figure 10. Insertion Loss vs. Frequency (FILTER6 Input to GND, CM1636-06DE)

Performance Information (cont'd)

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

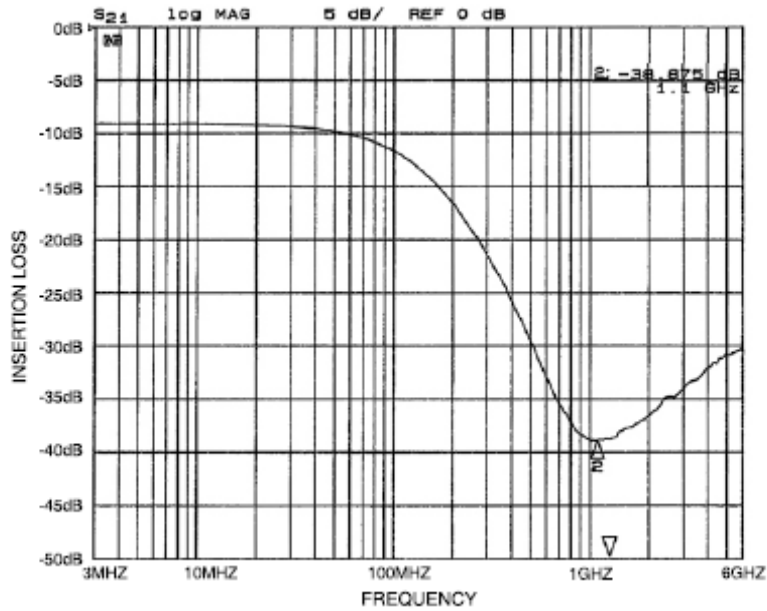


Figure 11. Insertion Loss vs. Frequency (FILTER1 Input to GND, CM1636-08DE)

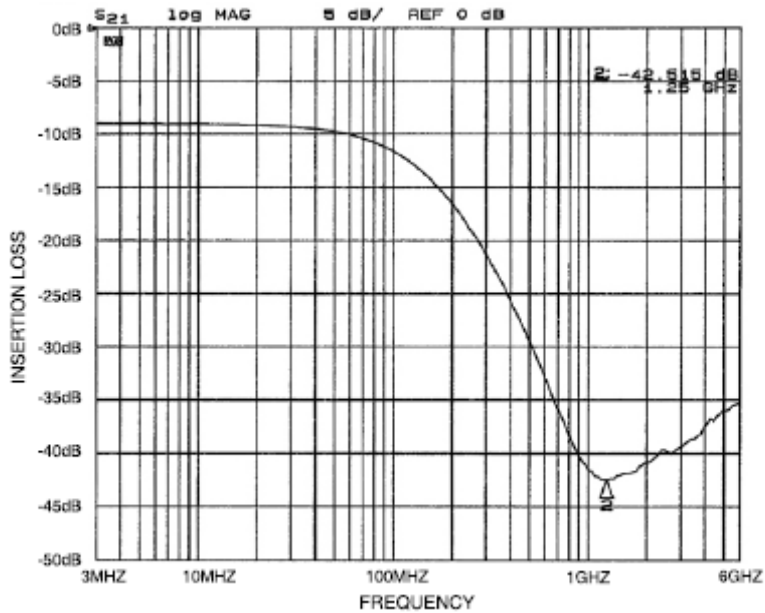


Figure 12. Insertion Loss vs. Frequency (FILTER2 Input to GND, CM1636-08DE)

## Performance Information (cont'd)

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

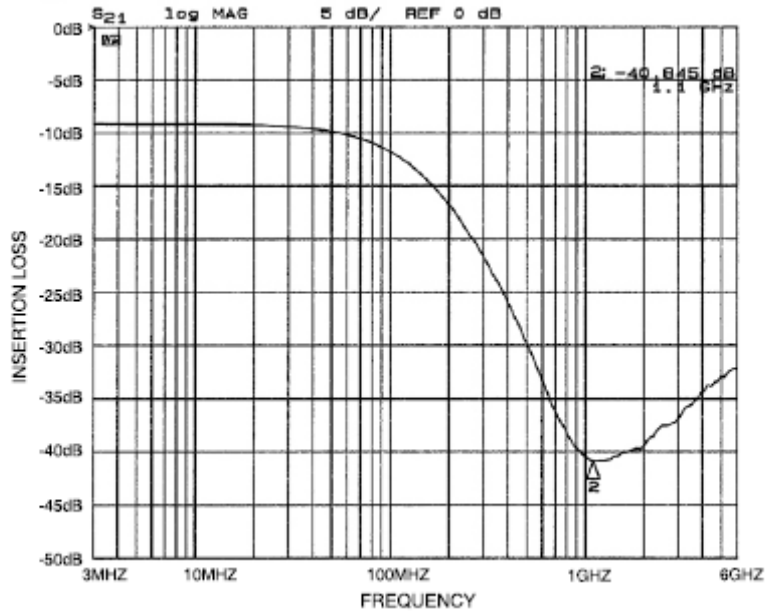


Figure 13. Insertion Loss vs. Frequency (FILTER3 Input to GND, CM1636-08DE)

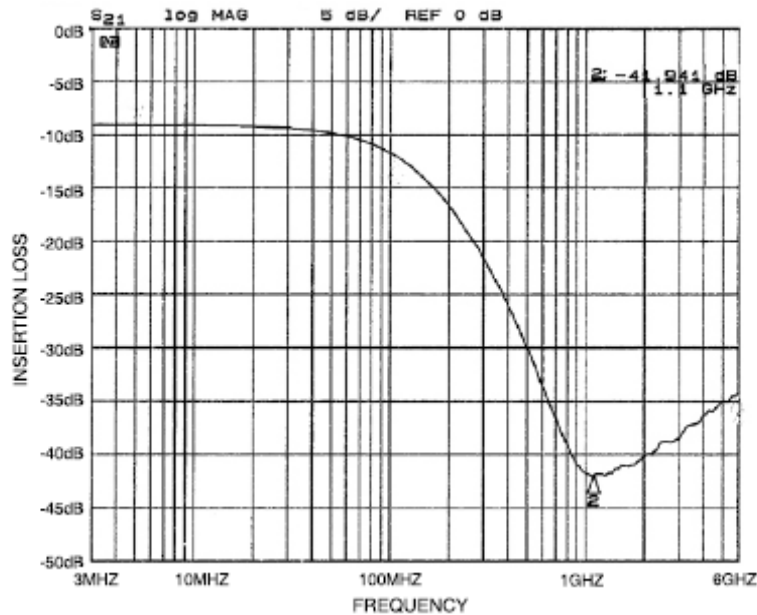


Figure 14. Insertion Loss vs. Frequency (FILTER4 Input to GND, CM1636-08DE)

Performance Information (cont'd)

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

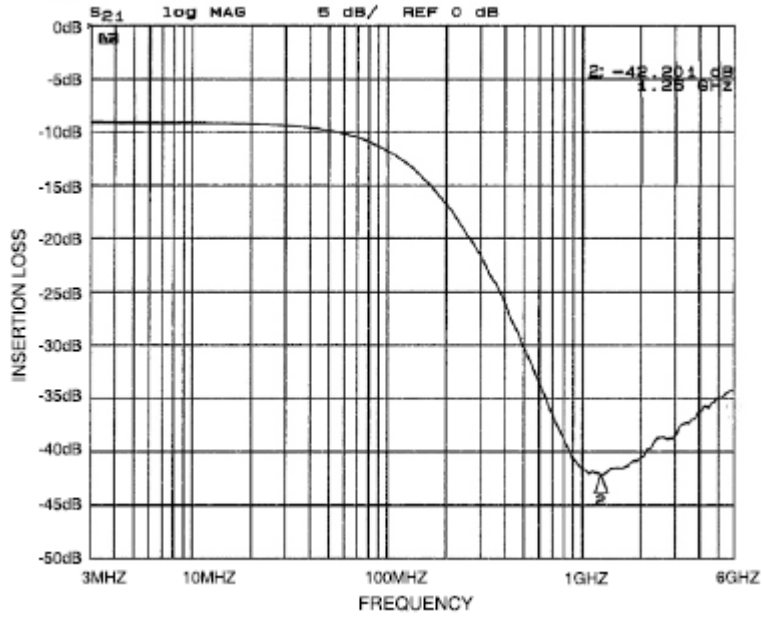


Figure 15. Insertion Loss vs. Frequency (FILTER5 Input to GND, CM1636-08DE)

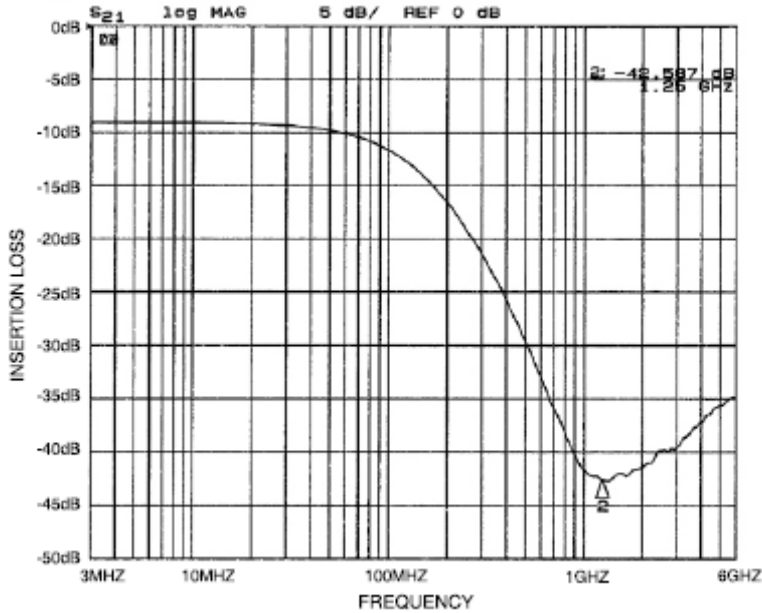


Figure 16. Insertion Loss vs. Frequency (FILTER6 Input to GND, CM1636-08DE)

### Performance Information (cont'd)

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

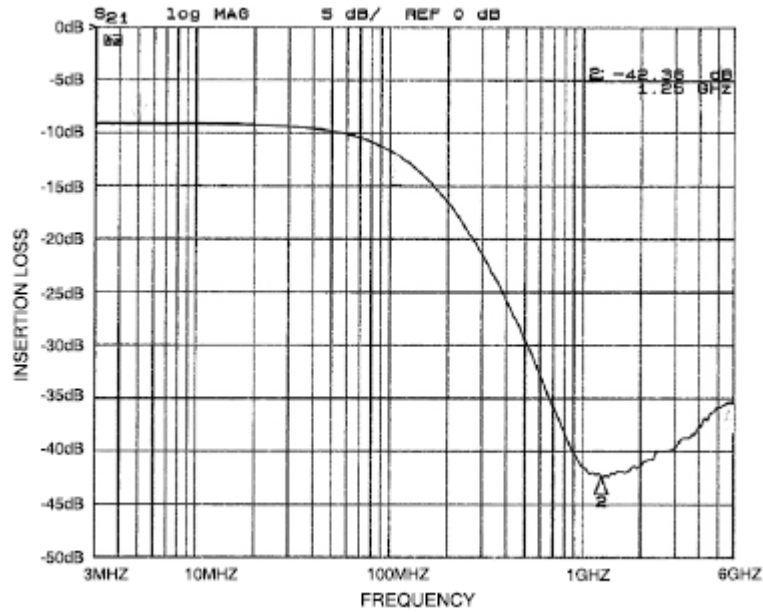


Figure 17. Insertion Loss vs. Frequency (FILTER7 Input to GND, CM1636-08DE)

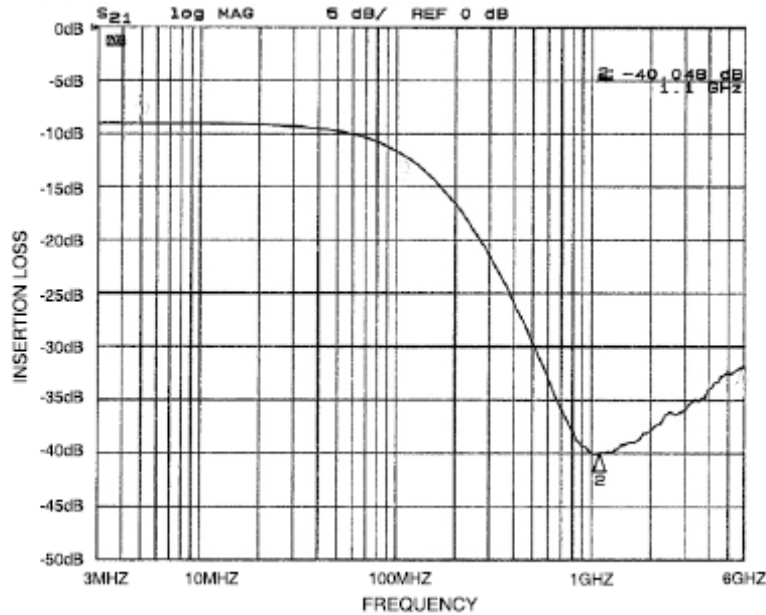


Figure 18. Insertion Loss vs. Frequency (FILTER8 Input to GND, CM1636-08DE)

Performance Information (cont'd)

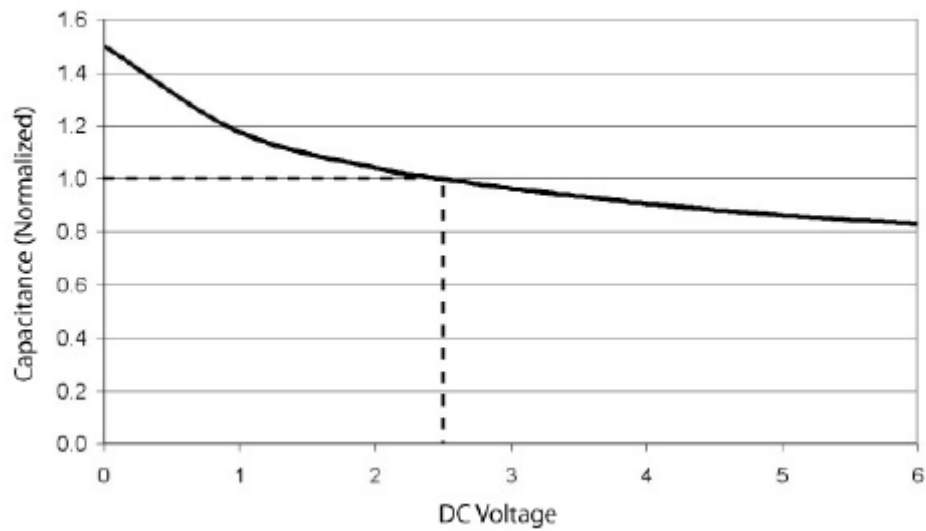


Figure 19. Filter Capacitance vs. Input Voltage over Temperature (normalized to capacitance at 2.5VDC and 25°C)



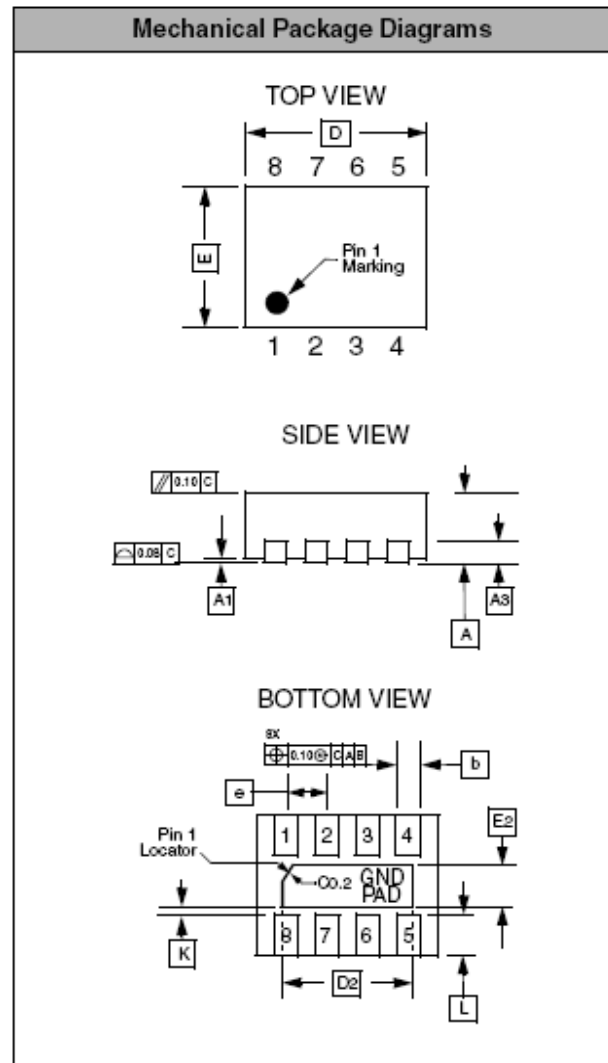
## Mechanical Details

### 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.

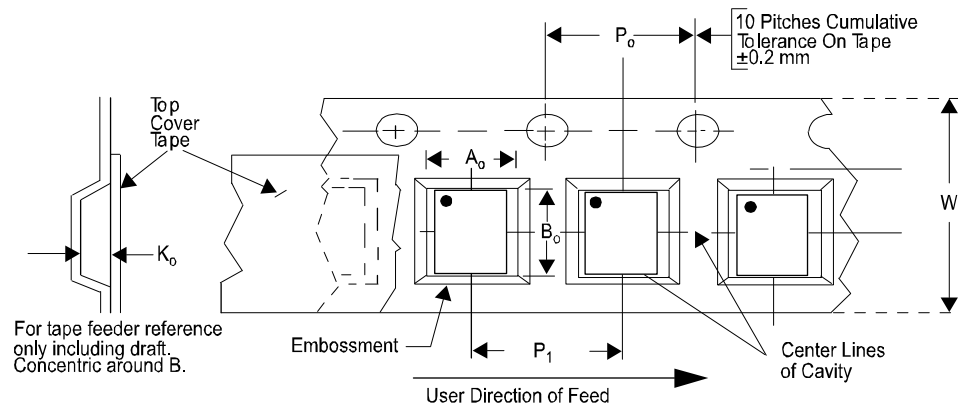


Dimensions for 8-Lead, 0.4mm pitch uDFN package

# CM1636

## 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



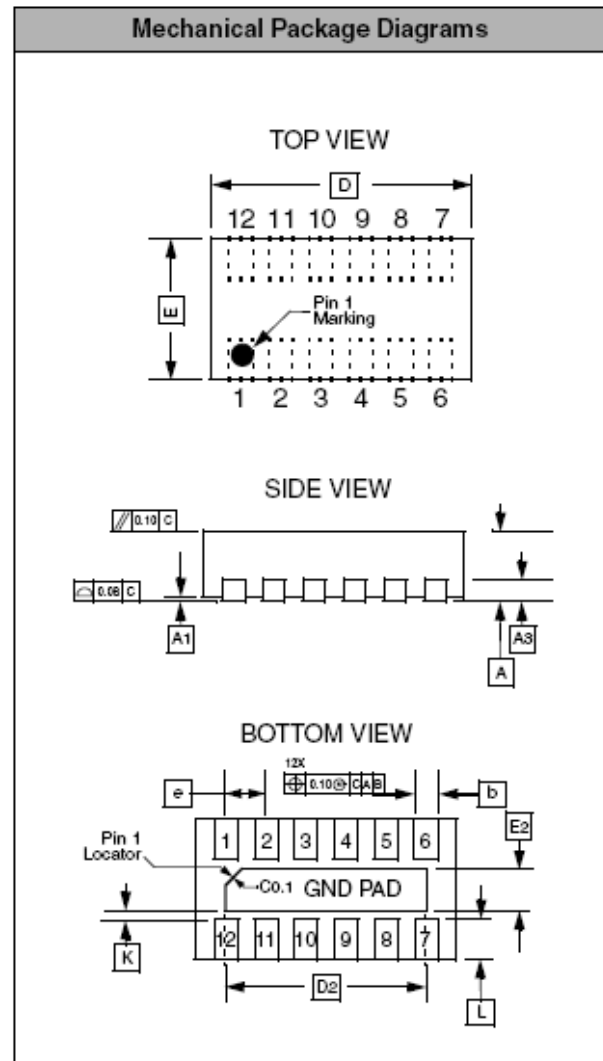
## Mechanical Details (cont'd)

### 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.

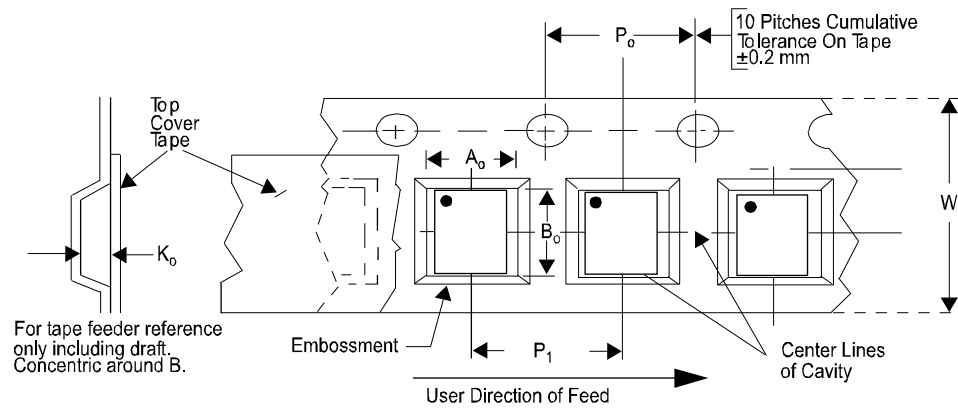


Dimensions for 12-Lead, 0.4mm pitch uDFN package

# CM1636

## 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	$P_o$	$P_1$
CM1636-06DE	2.50 X 1.35 X 0.50	2.75 X 1.60 X 0.60	8mm	178mm (7")	3000	4mm	4mm



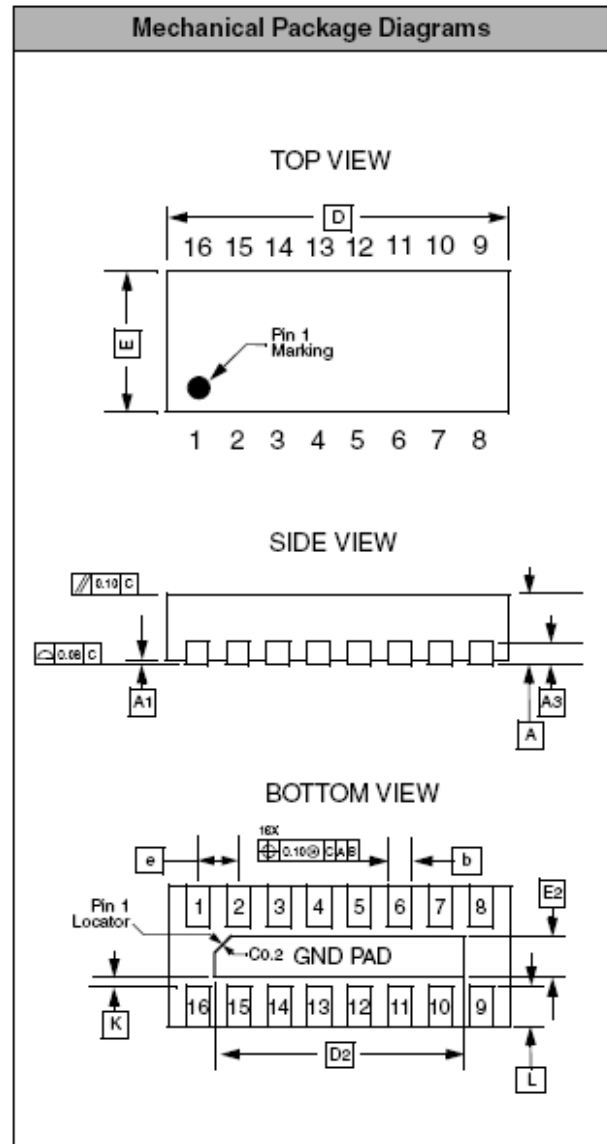
## Mechanical Details (cont'd)

### 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.

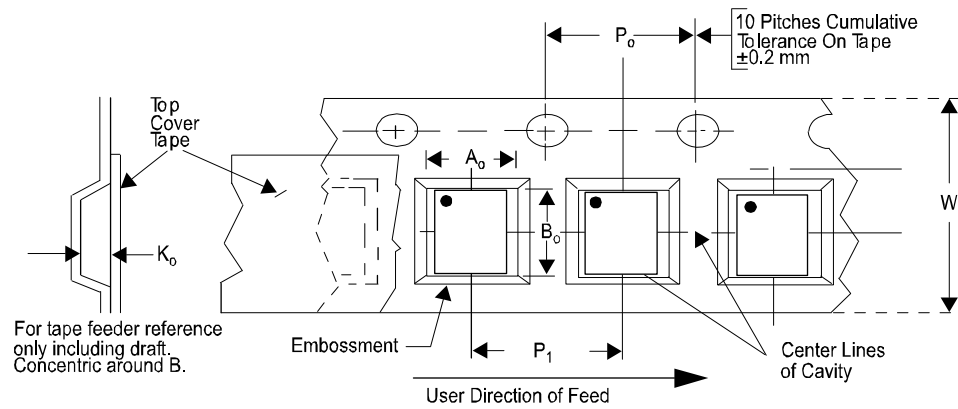



Dimensions for 16-Lead, 0.4mm pitch uDFN package

# CM1636

## 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



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