

## 4 and 8 Channel EMI Filter Arrays with ESD Protection

### Features

- Four and eight channels of EMI filtering with ESD protection
- Greater than 25dB of attenuation from 800MHz to 3GHz
- $\pm 15\text{kV}$  ESD protection (IEC 61000-4-2, contact discharge)
- $\pm 30\text{kV}$  ESD protection (MIL-STD-883, Method 3015, HBM)
- Fabricated with *Centurion*™ advanced low capacitance zener process technology
- Space saving, low profile 8 and 16-lead TDFN packages
- Lead-free version available

### 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

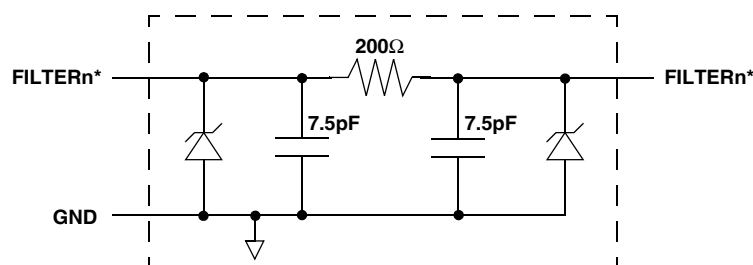
### Product Description

California Micro Devices's CM1407 is an EMI filter array with ESD protection, which integrates either four or eight pi filters (C-R-C). The CM1407 has component values of 7.5pF-200 $\Omega$ -7.5pF. The 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 CM1407 is ideal for EMI filtering and protecting data lines from ESD in wireless handsets.

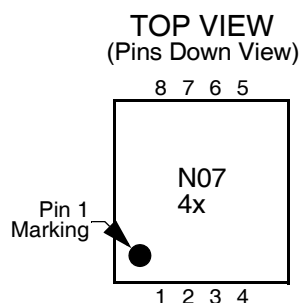
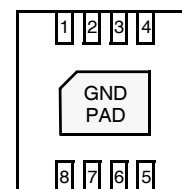
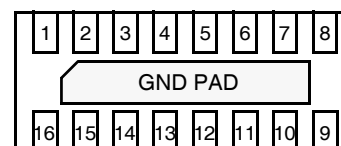
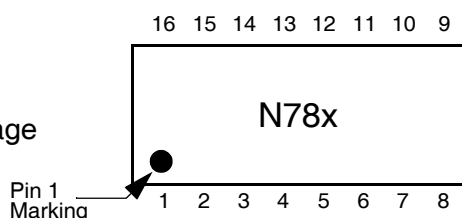
The CM1407 is available in space-saving, low-profile, 8 and 16-lead TDFN packages. It is fabricated with California Micro Devices' *Centurion*™ process and available with optional lead-free finishing.

### Electrical Schematic



1 of 4/8 EMI Filtering + ESD Channels

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

**PACKAGE / PINOUT DIAGRAMS**
**CM1407-04DE/DF**  
**8-Lead TDFN Package**

**BOTTOM VIEW**  
(Pins Up View)

**CM1407-08DE/DF**  
**16-Lead TDFN Package**

**Notes:**

- 1) This drawing is not to scale.
- 2) See Ordering Information section below for device specific marking.

**PIN DESCRIPTIONS**

Pins		NAME	DESCRIPTION		Pins		NAME	DESCRIPTION
CM1407-04Dx	CM1407-08Dx				CM1407-04Dx	CM1407-08Dx		
1	1	FILTER1	Filter Channel 1		8	16	FILTER1	Filter Channel 1
2	2	FILTER2	Filter Channel 2		7	15	FILTER2	Filter Channel 2
3	3	FILTER3	Filter Channel 3		6	14	FILTER3	Filter Channel 3
4	4	FILTER4	Filter Channel 4		5	13	FILTER4	Filter Channel 4
	5	FILTER5	Filter Channel 5			12	FILTER5	Filter Channel 5
	6	FILTER6	Filter Channel 6			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	Standard Finish		Lead-free Finish	
		Ordering Part Number <sup>1</sup>	Part Marking	Ordering Part Number <sup>1</sup>	Part Marking
8	TDFN-08	CM1407-04DF	N07 4F	CM1407-04DE	N07 4E
16	TDFN-16	CM1407-08DF	N78F	CM1407-08DE	N78E

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 Rating 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	Ω
C	Capacitance	At 2.5V DC, 1MHz, 30mV AC	6	7.5	9	pF
V <sub>DIODE</sub>	Diode Standoff Voltage	I <sub>DIODE</sub> = 10μA		6.0		V
I <sub>LEAK</sub>	Diode Leakage Current (reverse bias)	V <sub>DIODE</sub> = 3.3V		0.1	1	μA
V <sub>SIG</sub>	Signal Voltage Positive Clamp Negative Clamp	I <sub>LOAD</sub> = 10mA I <sub>LOAD</sub> = -10mA	5.6 -1.5	6.8 -0.8	9.0 -0.4	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 and 3	±30 ±15			kV kV
f <sub>C</sub>	Cut-off Frequency Z <sub>SOURCE</sub> =50Ω, Z <sub>LOAD</sub> =50Ω	R = 200Ω, C = 15pF; Note 3		210		MHz

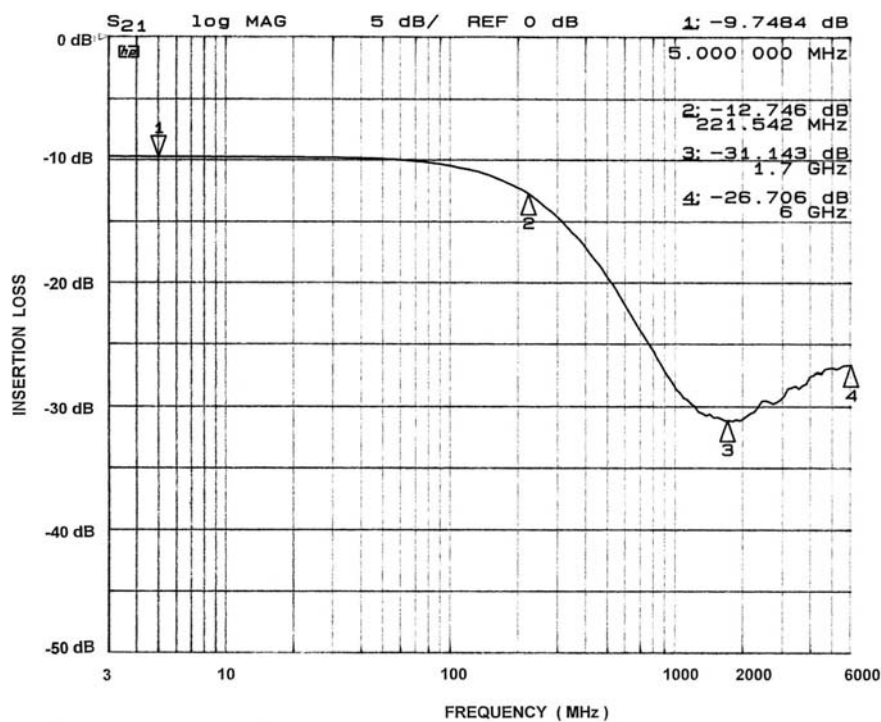
Note 1: T<sub>A</sub>=25°C unless otherwise specified.

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

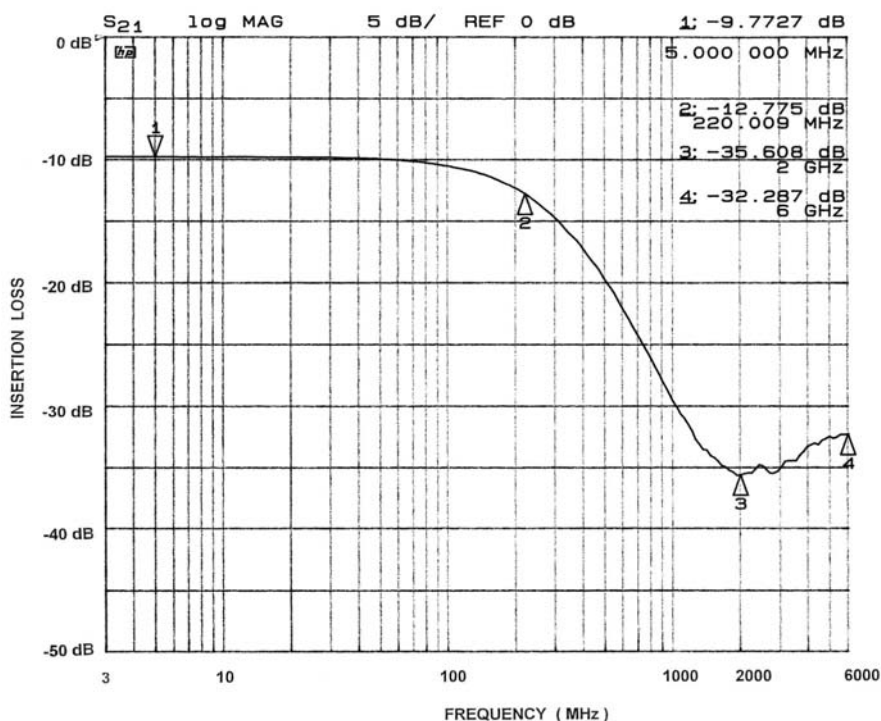
Note 3: These parameters are guaranteed by design and characterization.

## Performance Information

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)



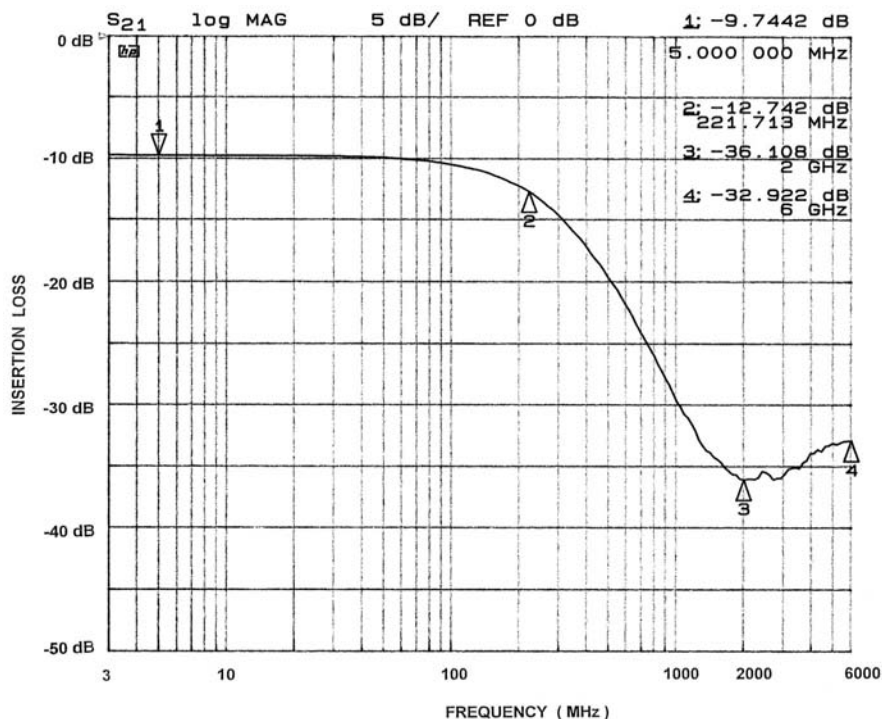
**Figure 1. Channel 1 EMI Filter Performance (CM1407-04)**



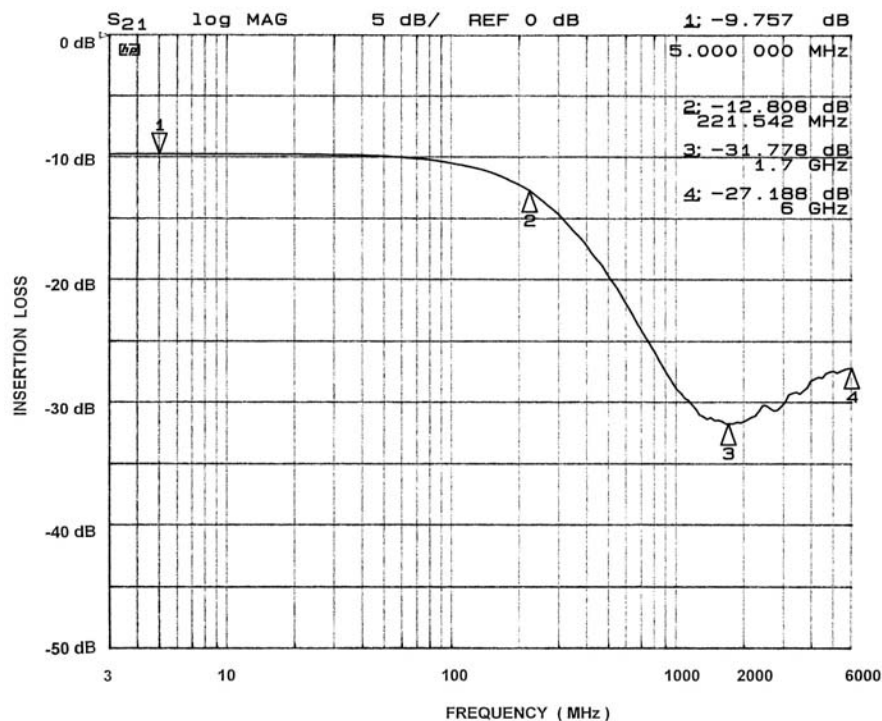
**Figure 2. Channel 2 EMI Filter Performance (CM1407-04)**

## Performance Information (cont'd)

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)



**Figure 3. Channel 3 EMI Filter Performance (CM1407-04)**



**Figure 4. Channel 4 EMI Filter Performance (CM1407-04)**

## Performance Information (cont'd)

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)

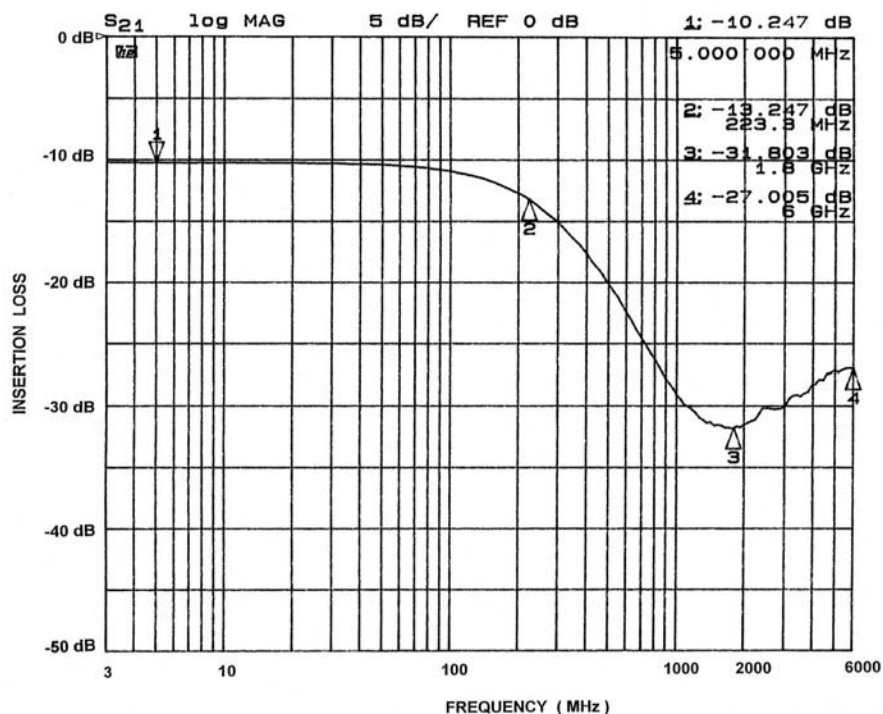


Figure 5. Channel 1 EMI Filter Performance (CM1407-08)

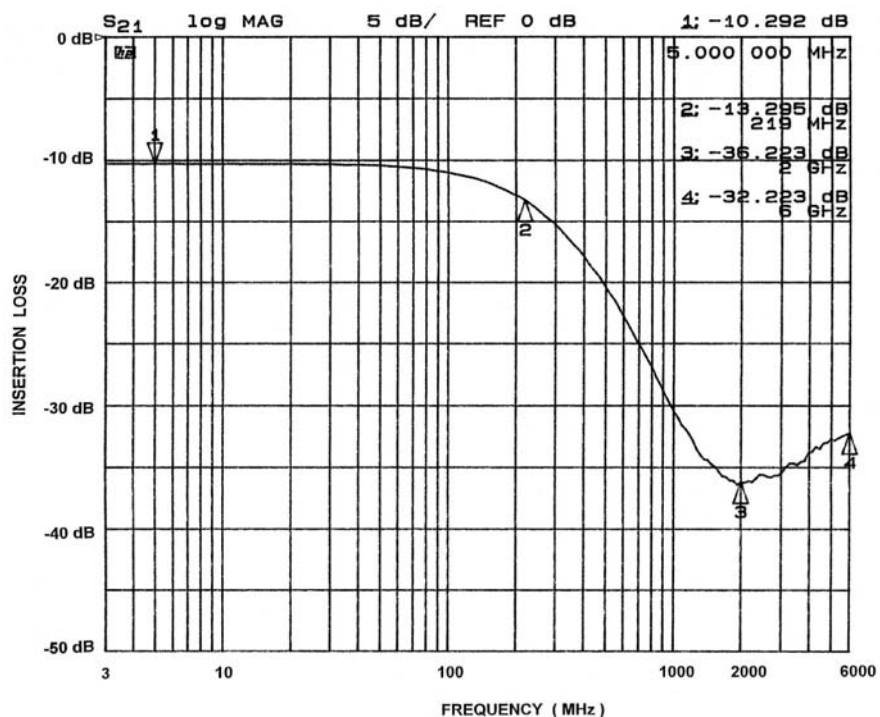
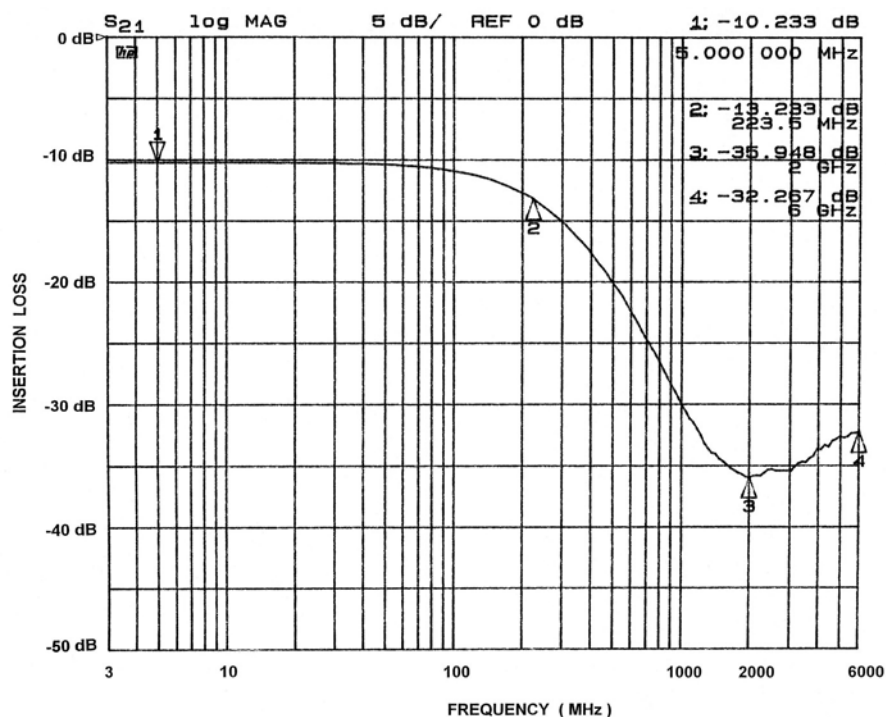


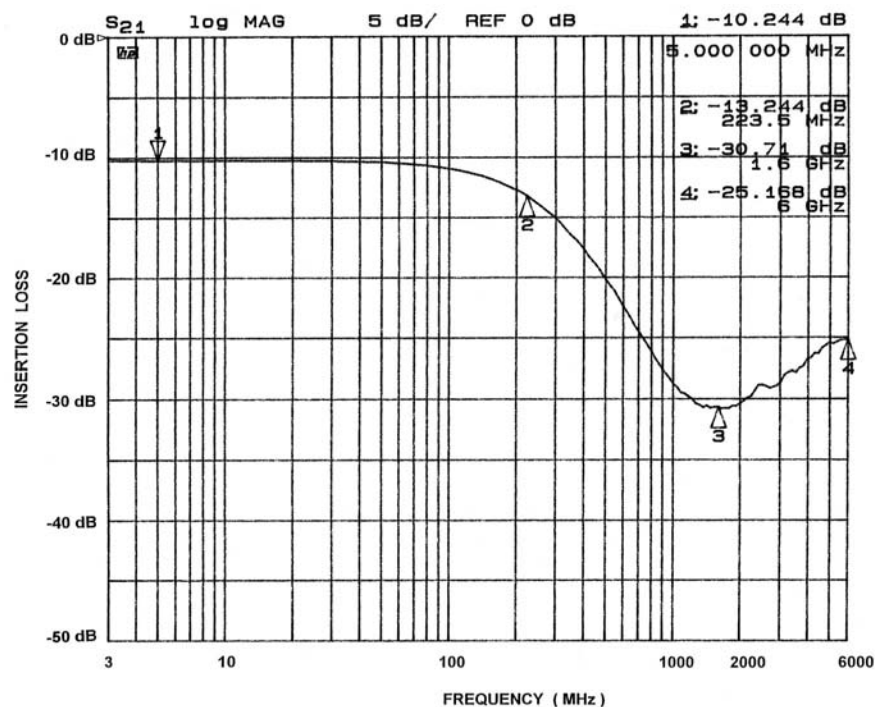
Figure 6. Channel 2 EMI Filter Performance (CM1407-08)

## Performance Information (cont'd)

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)



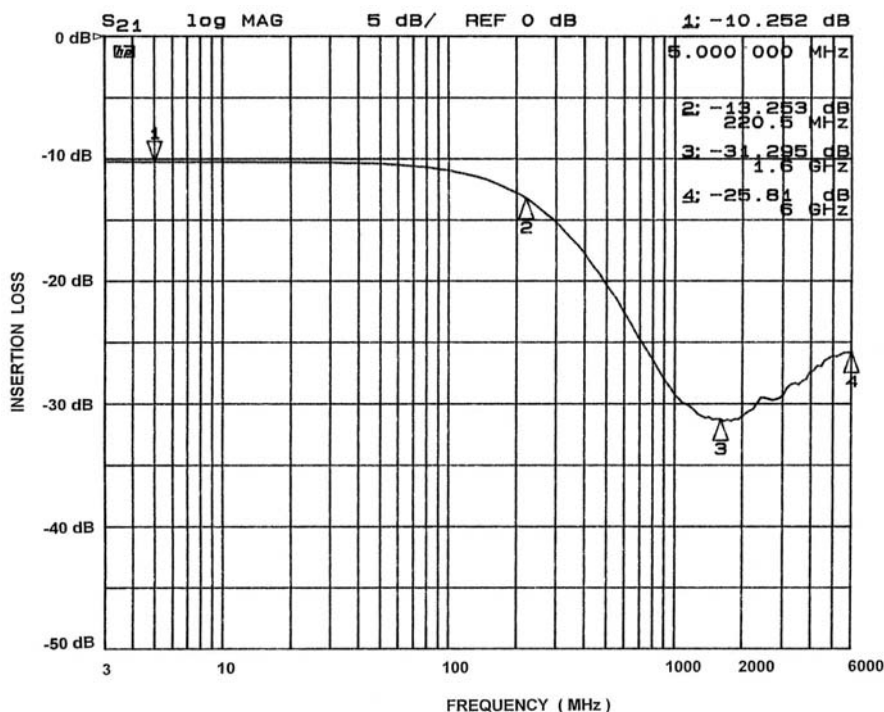
**Figure 7. Channel 3 EMI Filter Performance (CM1407-08)**



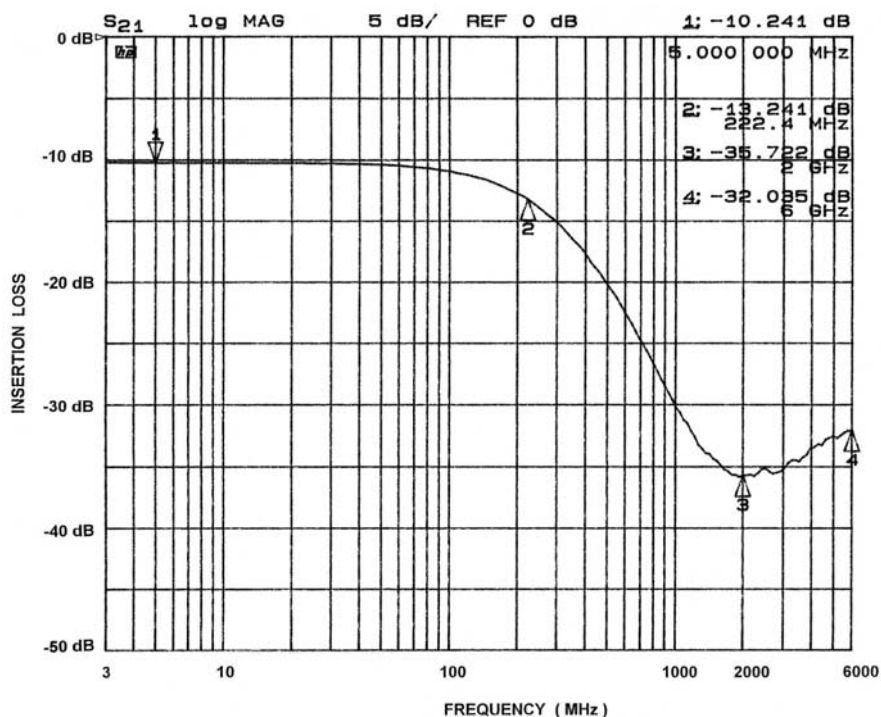
**Figure 8. Channel 4 EMI Filter Performance (CM1407-08)**

## Performance Information (cont'd)

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)



**Figure 9. Channel 5 EMI Filter Performance (CM1407-08)**

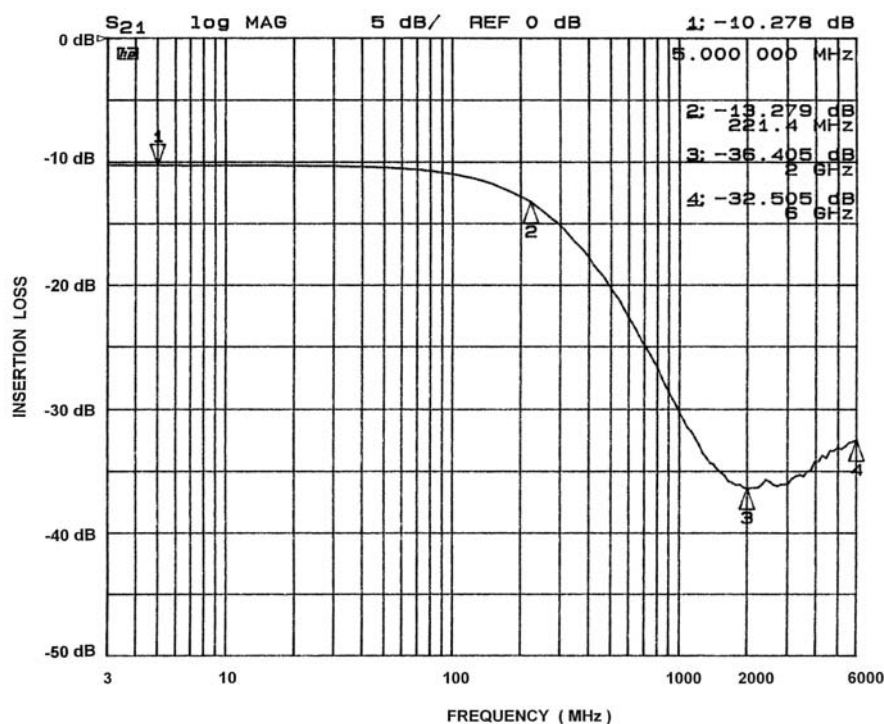


**Figure 10. Channel 6 EMI Filter Performance (CM1407-08)**

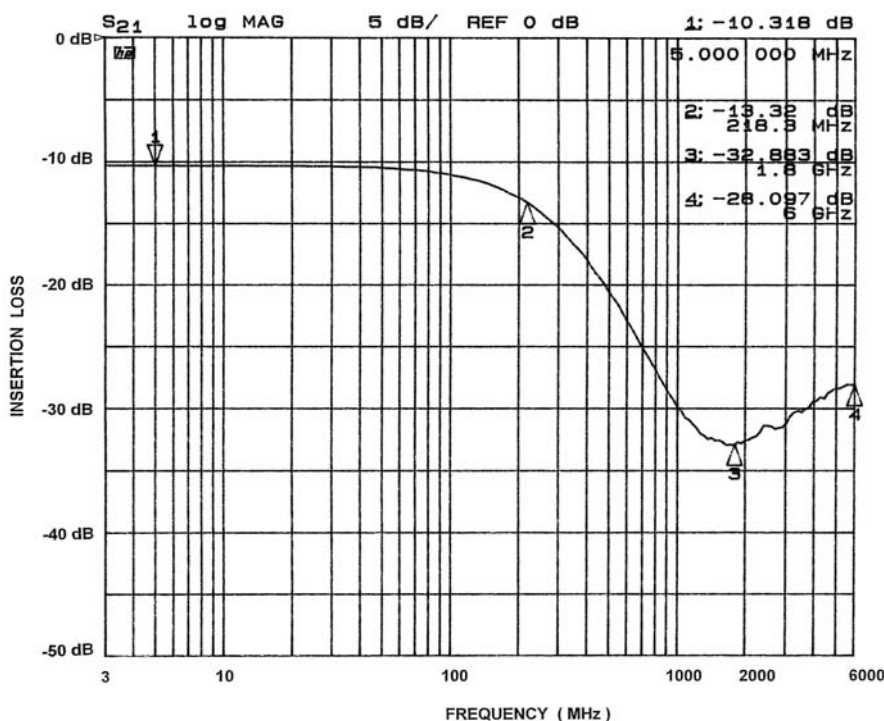


## Performance Information (cont'd)

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)

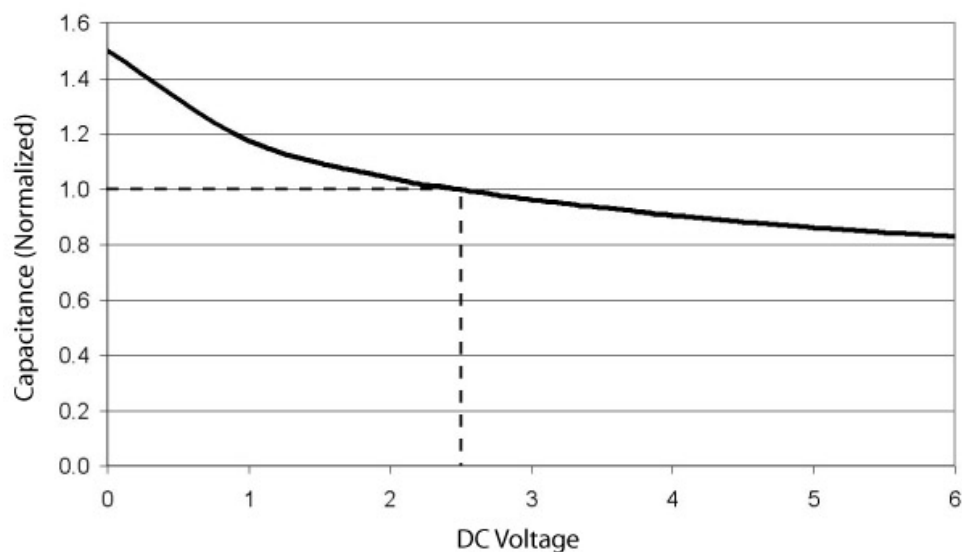


**Figure 11. Channel 7 EMI Filter Performance (CM1407-08)**



**Figure 12. Channel 8 EMI Filter Performance (CM1407-08)**

## Performance Information (cont'd)



**Figure 13. Filter Capacitance vs. Input Voltage over Temperature**  
(normalized to capacitance at 2.5VDC and 25°C)

## Mechanical Details

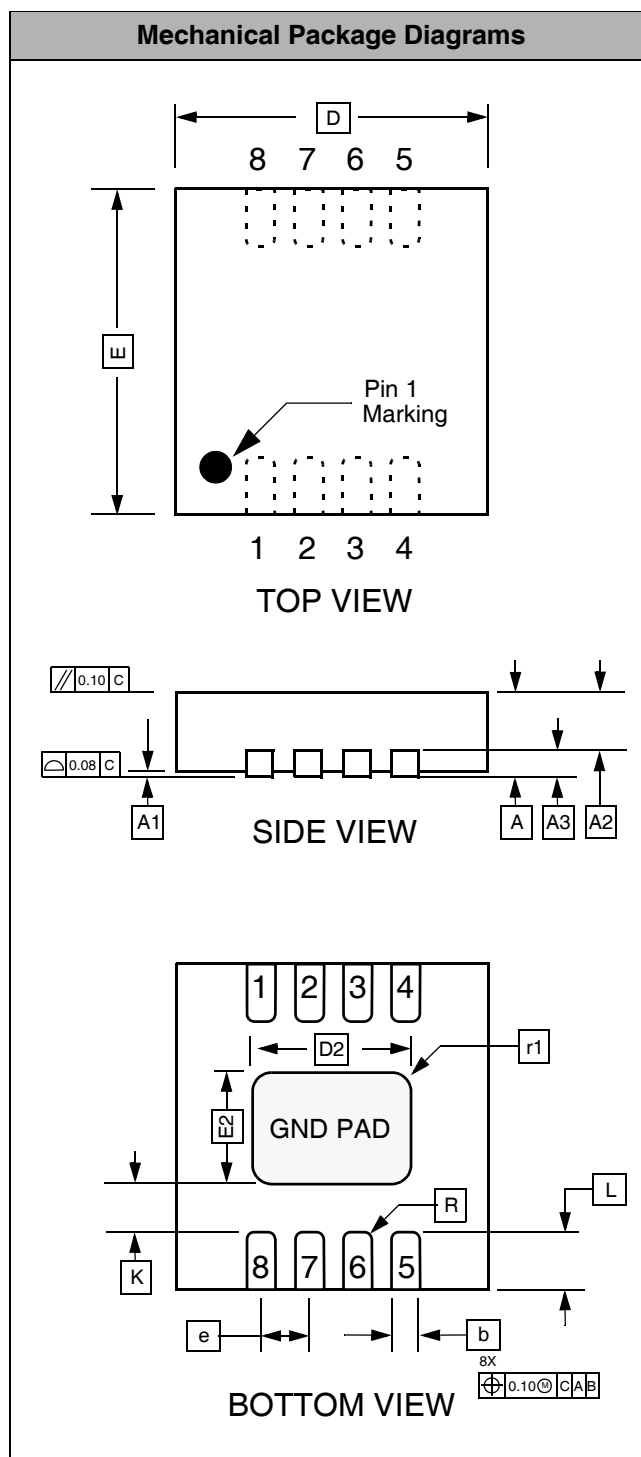
### TDFN-08 Mechanical Specifications

Dimensions for the CM1407 device packaged in an 8-lead TDFN package are presented below.

For complete information on the TDFN-08, see the California Micro Devices TDFN Package Information document.

PACKAGE DIMENSIONS						
Package	TDFN					
JEDEC No.	MO-229 (Var. VCCD-3) <sup>†</sup>					
Leads	8					
Dim.	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A	0.80	0.90	1.00	0.031	0.035	0.039
A1	0.00	0.02	0.05	0.000	0.001	0.002
A2	0.55	0.65	0.80	0.022	0.026	0.031
A3		0.20			0.008	
b	0.18	0.25	0.30	0.007	0.010	0.012
D		2.00			0.079	
D2	0.88	0.98	1.08	0.035	0.039	0.043
E		2.00			0.079	
E2	0.46	0.56	0.66	0.018	0.022	0.026
e		0.50			0.020	
K	0.20			0.008		
L	0.20	0.30	0.45	0.008	0.012	0.018
R		0.075			0.003	
r1		0.075			0.003	
# per tube	NA					
# per tape and reel	3000 pieces					
Controlling dimension: millimeters						

<sup>†</sup>This package is compliant with JEDEC standard MO-229, variation VCCD-3 with exception of the "D2" and "E2" dimensions as called out in the table above and the "r1" dimension which is not specified in the MO-229 standard.



**Package Dimensions for 8-Lead TDFN**

## Mechanical Details (cont'd)

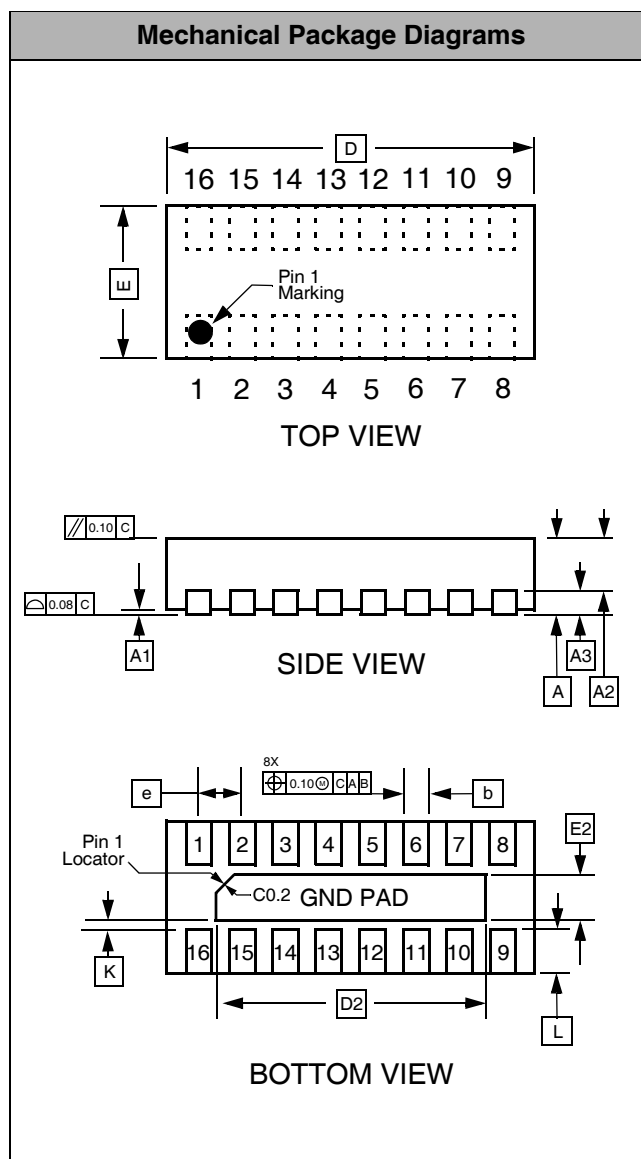
### TDFN-16 Mechanical Specifications

Dimensions for the CM1407 supplied in a 16-lead TDFN package are presented below.

For complete information on the TDFN-16, see the California Micro Devices TDFN Package Information document.

PACKAGE DIMENSIONS						
Package	TDFN					
JEDEC No.	MO-229C <sup>†</sup>					
Leads	16					
Dim.	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A	0.70	0.75	0.80	0.028	0.030	0.031
A1	0.00	0.02	0.05	0.000	0.001	0.002
A2	0.45	0.55	0.65	0.018	0.022	0.026
A3		0.20			0.008	
b	0.20	0.25	0.30	0.008	0.010	0.012
D	3.90	4.00	4.10	0.154	0.157	0.161
D2	3.10	3.20	3.30	0.122	0.126	0.130
E	1.50	1.60	1.70	0.059	0.063	0.067
E2	0.30	0.40	0.50	0.012	0.016	0.020
e		0.50			0.020	
K	0.10	0.30	0.50	0.004	0.012	0.020
L	0.20	0.30	0.40	0.008	0.012	0.016
# per tube	NA					
# per tape and reel	3000 pieces					
Controlling dimension: millimeters						

<sup>†</sup>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.



Package Dimensions for 16-Lead TDFN