

## 4 Channel EMI Filter Array with ESD Protection

### Features

- Four channels of EMI filtering with ESD protection
- Greater than 30dB of attenuation from 800MHz to 3GHz
- $\pm 15\text{kV}$  ESD protection (IEC 61000-4-2, contact discharge)
- $\pm 30\text{kV}$  ESD protection (HBM)
- 8-lead TDFN package (2mm x 2mm), 0.5mm pitch
- 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 and chip-to-chip data lines

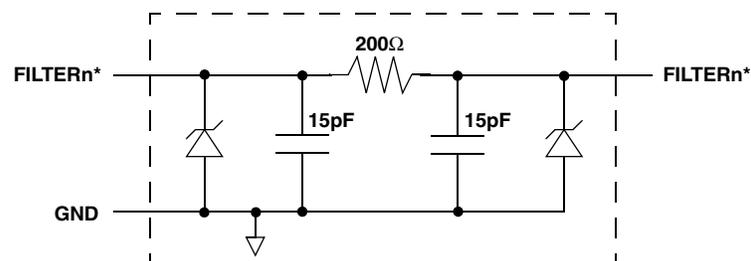
### Product Description

California Micro Devices's CM1406 is an EMI filter array with ESD protection, which integrates 4 pi filters (C-R-C). The CM1406 has component values of 15pF-200 $\Omega$ -15pF. The parts include ESD protection diodes on every pin, which provide 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 are designed and characterized to 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 format and easy-to-use pin assignments. In particular, the CM1406 is ideal for EMI filtering and protecting data lines from ESD in wireless handsets.

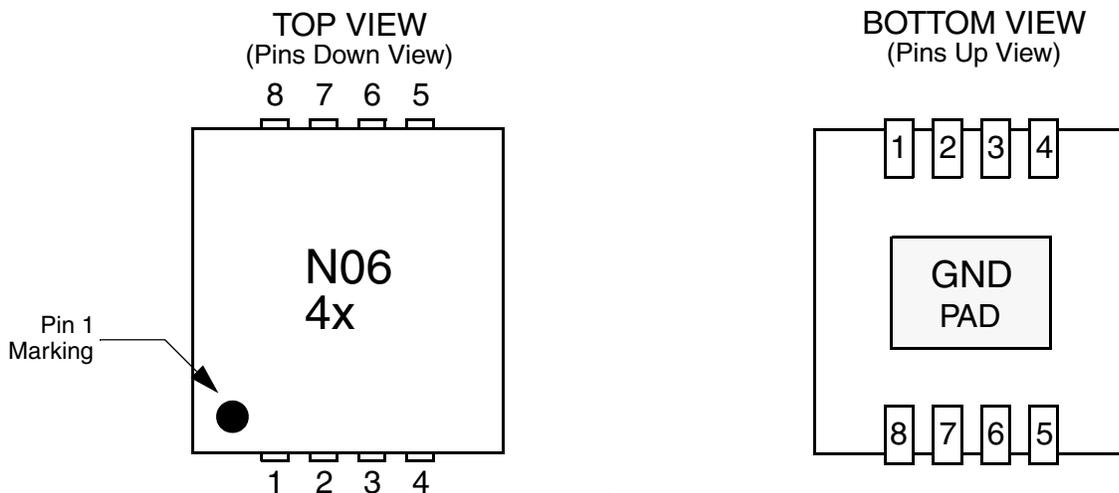
The CM1406 is available in a space-saving, low-profile, 8-lead, 2mm x 2mm TDFN package. It is fabricated with California Micro Devices' Centurion™ process and available with optional lead-free finishing.

### Electrical Schematic



1 of 4 EMI Filtering + ESD Channels

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

**PACKAGE / PINOUT DIAGRAMS**

**CM1406**  
8-Lead TDFN Package

**Notes:**

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

**PIN DESCRIPTIONS**

PIN(s)	NAME	DESCRIPTION	PIN(s)	NAME	DESCRIPTION
1	FILTER1	Filter Channel 1	5	FILTER4	Filter Channel 4
2	FILTER2	Filter Channel 2	6	FILTER3	Filter Channel 3
3	FILTER3	Filter Channel 3	7	FILTER2	Filter Channel 2
4	FILTER4	Filter Channel 4	8	FILTER1	Filter Channel 1
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	CM1406-04DF	N06 4F	CM1406-04DE	N06 4E

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
DC Package 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	12	15	18	pF
V <sub>DIODE</sub>	Diode Standoff Voltage	I <sub>DIODE</sub> = 10μA	5.5			V
I <sub>LEAK</sub>	Diode Leakage Current (reverse bias)	V <sub>DIODE</sub> = 3.3V		100		nA
V <sub>SIG</sub>	Signal Voltage					
	Positive Clamp	I <sub>LOAD</sub> = 10mA	5.6	6.8	9.0	V
	Negative Clamp	I <sub>LOAD</sub> = -10mA	-0.4	-0.8	-1.5	V
V <sub>ESD</sub>	In-system ESD Withstand Voltage	Notes 2,4 and 5				
	a) Human Body Model, MIL-STD-883, Method 3015		±30			kV
	b) Contact Discharge per IEC 61000-4-2 Level 4		±15			kV
V <sub>CL</sub>	Clamping Voltage during ESD Discharge MIL-STD-883 (Method 3015), 8kV	Notes 2,3,4 and 5				
	Positive Transients			+12		V
	Negative Transients			-7		V
f <sub>C</sub>	Cut-off Frequency	R = 200Ω, C = 15pF				
	Z <sub>SOURCE</sub> =50Ω, Z <sub>LOAD</sub> =50Ω			105		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.

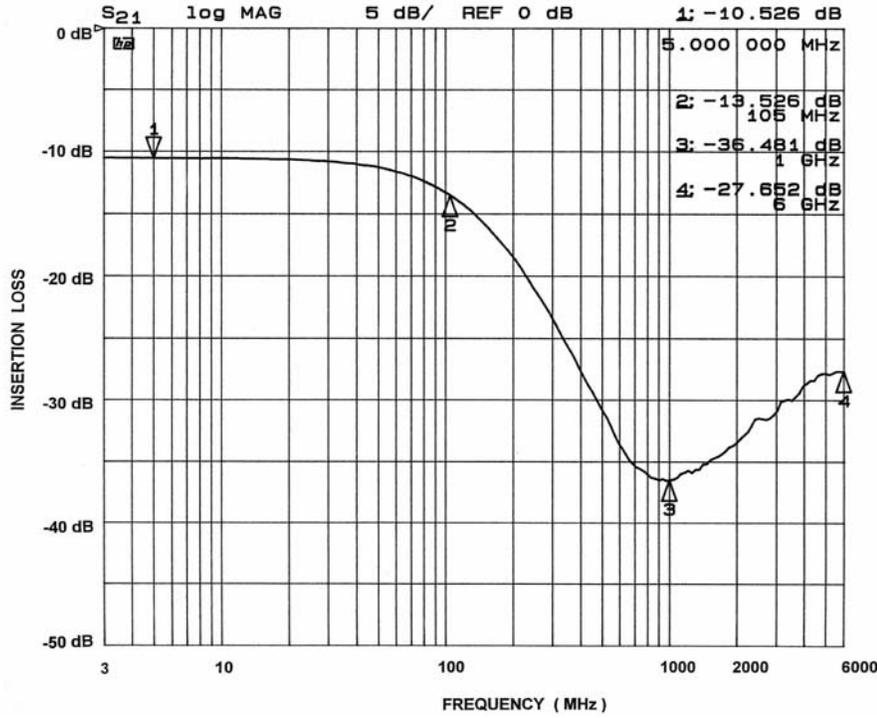
Note 3: Clamping voltage is measured at the opposite side of the EMI filter to the ESD pin. For example, if ESD is applied to Pin 1, then clamping voltage is measured at Pin 8.

Note 4: Unused pins are left open

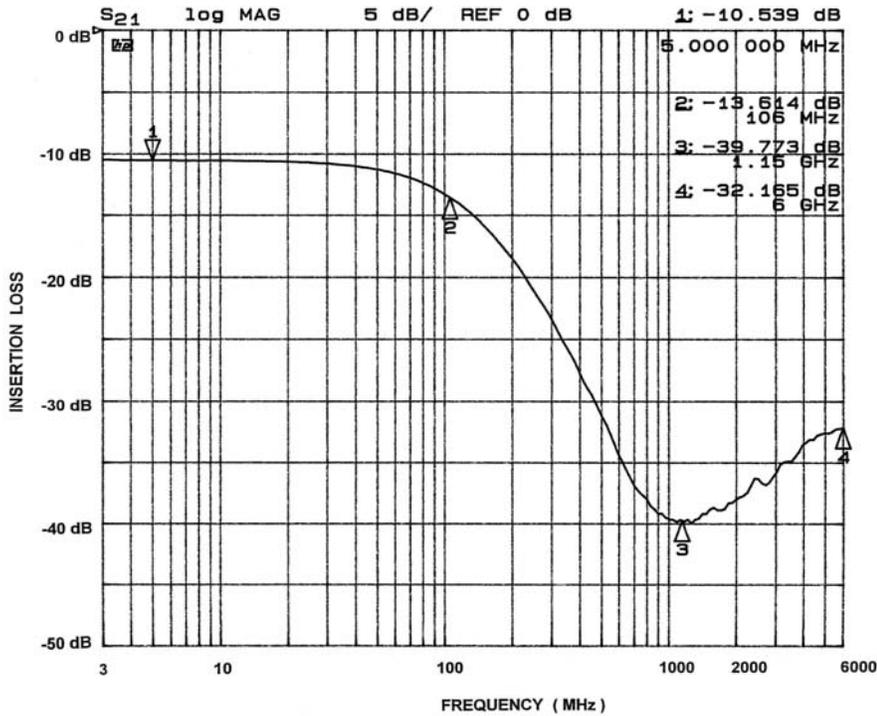
Note 5: These parameters are guaranteed by design and characterization.

**Performance Information**

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



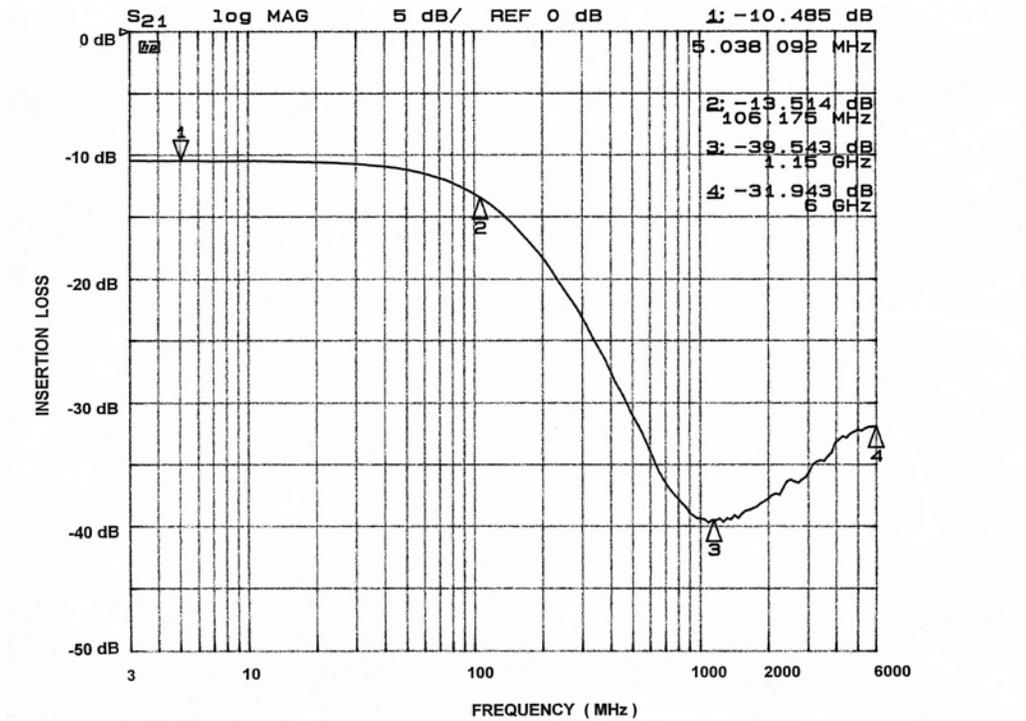
**Figure 1. Channel 1 (Pin 1 - Pin 8) EMI Filter Performance**



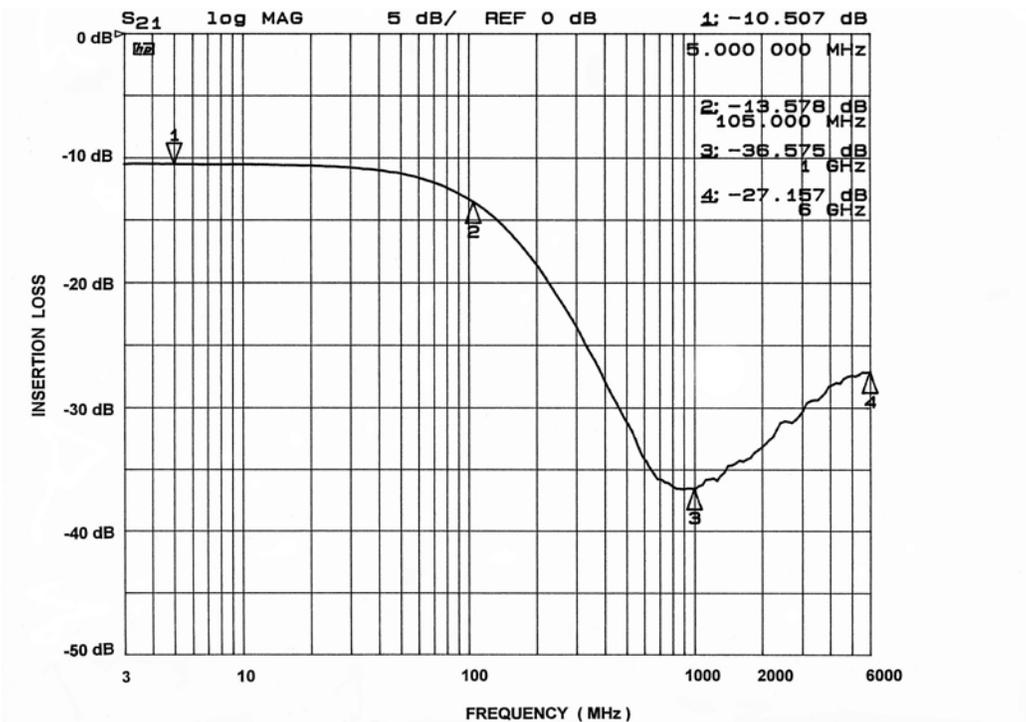
**Figure 2. Channel 2 (Pin 2 - Pin 7) EMI Filter Performance**

**Performance Information (cont'd)**

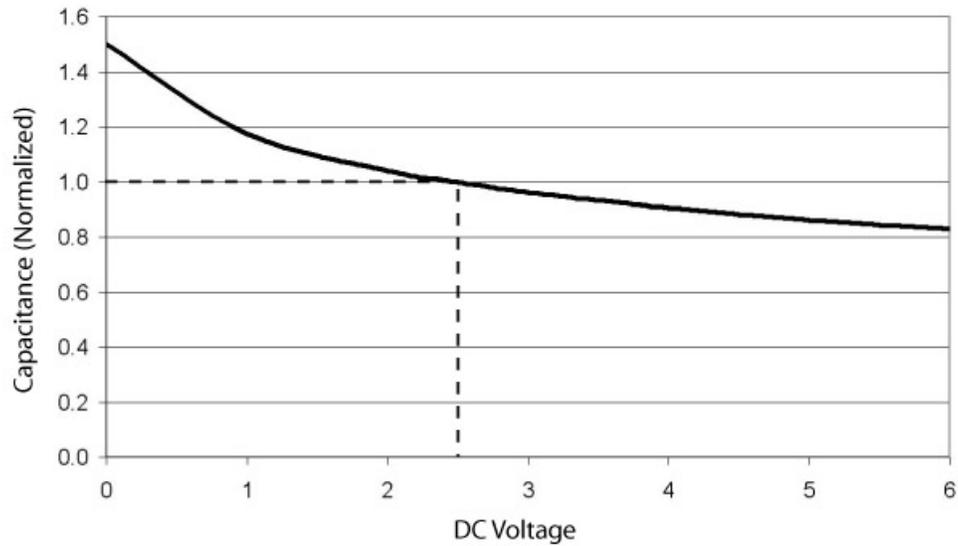
**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)



**Figure 3. Channel 3 (Pin 3 - Pin 6) EMI Filter Performance**



**Figure 4. Channel 4 (Pin 4 - Pin 5) EMI Filter Performance**

**Performance Information (cont'd)**

**Figure 5. Filter Capacitance vs. Input Voltage over Temperature  
(normalized to capacitance at 2.5VDC and 25°C)**

## Mechanical Details

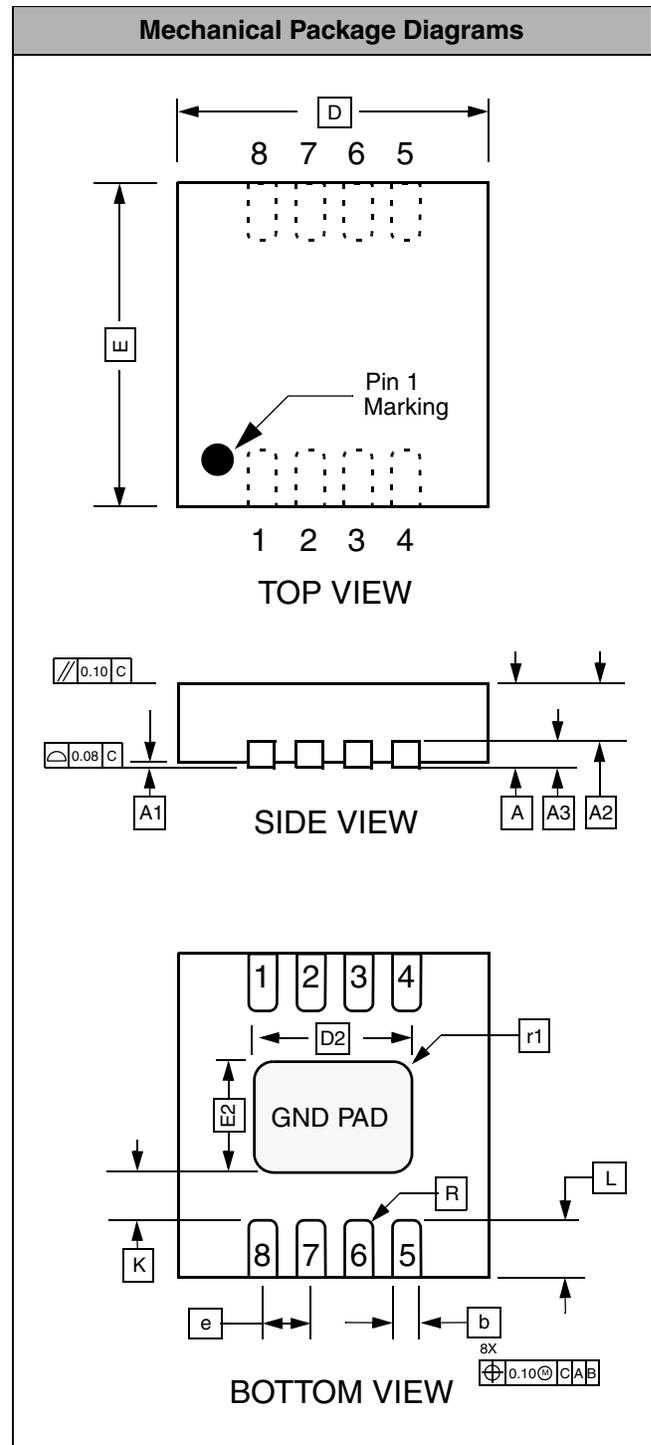
### TDFN-08 Mechanical Specifications

Dimensions for CM1406 device packaged in an 8-lead TDFN package are presented below.

For complete information on the TDFN-08 package, 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
L2			0.13			0.005
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**