

## Praetorian™ L-C LCD and Camera EMI Filter Array with ESD Protection

### Features

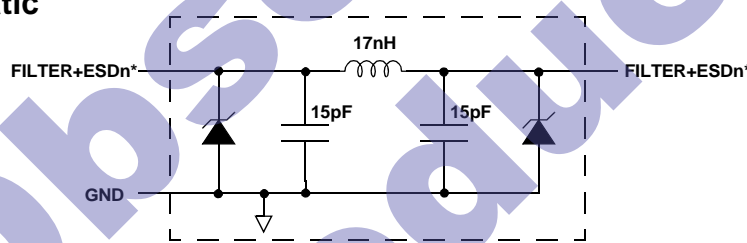
- Four, six and eight channels of EMI filtering with integrated ESD protection
- Pi-style EMI filters in a capacitor-resistor-capacitor (C-R-C) network
- ±15kV ESD protection on each channel (IEC 61000-4-2 Level 4, contact discharge)
- ±30kV ESD protection on each channel (HBM)
- Greater than -35dB attenuation (typical) at 1 GHz
- uDFN package with 0.50mm lead pitch:
  - 4-ch. = 8-lead uDFN
  - 6-ch. = 12-lead uDFN
  - 8-ch. = 16-lead uDFN
- Tiny uDFN package size:
  - 8-lead: 2.00mm x 2.00mm x 0.5mm
  - 12-lead: 3.00mm x 1.35mm x 0.5mm
  - 16-lead: 4.00mm x 1.60mm x 0.5mm

- Increased robustness against vertical impacts during manufacturing process
- Lead-free version

### Applications

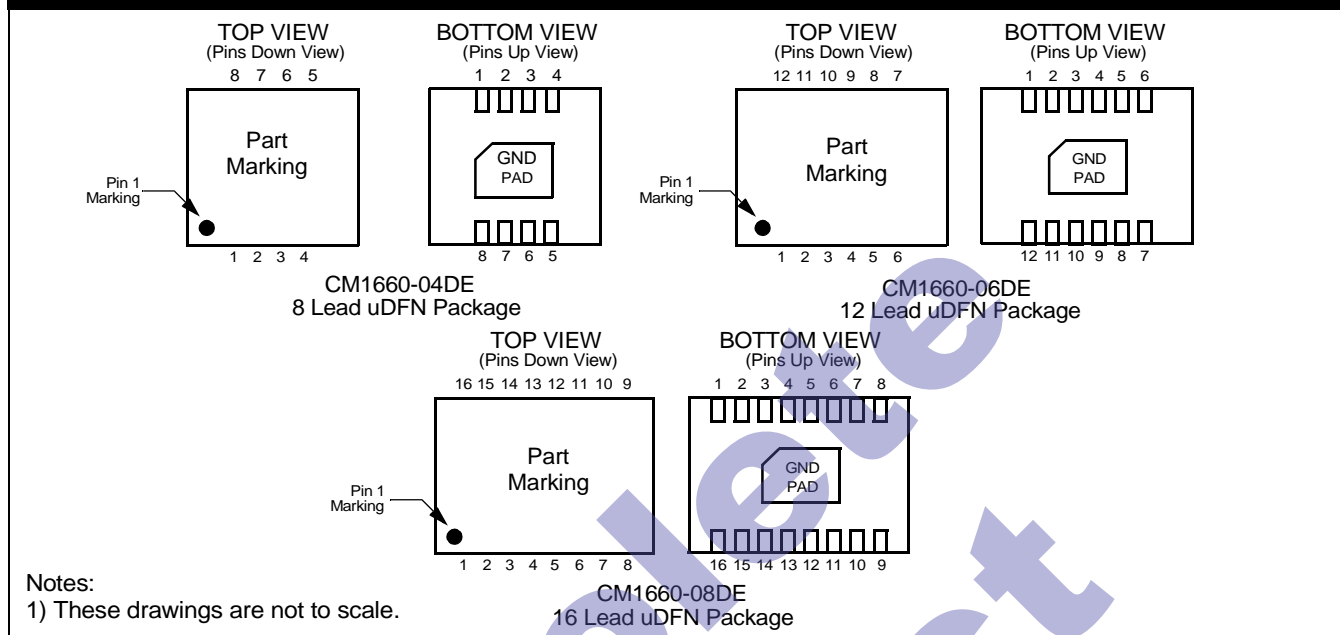
- LCD and Camera data lines in mobile handsets
- I/O port protection for mobile handsets, notebook computers, PDAs etc.
- EMI filtering for data ports in cell phones, PDAs or notebook computers.
- Wireless handsets
- Handheld PCs/PDAs
- LCD and camera modules

### Electrical Schematic



**1 of 4, 6 or 8 EMI/RFI Filter Channels  
with Integrated ESD Protection**

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

**PACKAGE / PINOUT DIAGRAMS**

**PIN DESCRIPTIONS**

DEVICE PIN(s)			NAME	DESCRIPTION	DEVICE PIN(s)			NAME	DESCRIPTION
-04	-06	-08			-04	-06	-08		
1	1	1	FILTER1	Filter + ESD Channel 1	8	12	16	FILTER1	Filter + ESD Channel 1
2	2	2	FILTER2	Filter + ESD Channel 2	7	11	15	FILTER2	Filter + ESD Channel 2
3	3	3	FILTER3	Filter + ESD Channel 3	6	10	14	FILTER3	Filter + ESD Channel 3
4	4	4	FILTER4	Filter + ESD Channel 4	5	9	13	FILTER4	Filter + ESD Channel 4
	5	5	FILTER5	Filter + ESD Channel 5		8	12	FILTER5	Filter + ESD Channel 5
	6	6	FILTER6	Filter + ESD Channel 6		7	11	FILTER6	Filter + ESD Channel 6
		7	FILTER7	Filter + ESD Channel 7			10	FILTER7	Filter + ESD Channel 7
		8	FILTER8	Filter + ESD Channel 8			9	FILTER8	Filter + ESD Channel 8
GND PAD			GND	Device Ground					

**Ordering Information**
**PART NUMBERING INFORMATION**

Pins	Package	Lead-free Finish	
		Ordering Part Number <sup>1</sup>	Part Marking
8	uDFN-8	CM1660-04DE	ME
12	uDFN-12	CM1660-06DE	P60E
16	uDFN-16	CM1660-08DE	P608E

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
Current per Inductor	30	mA
DC Package Power Rating	500	mW

### STANDARD OPERATING CONDITIONS

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

### ELECTRICAL OPERATING CHARACTERISTICS (SEE NOTE1)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
L	Channel Inductance			17		nH
C <sub>TOTAL</sub>	Total Channel Capacitance	At 2.5VDC Reverse Bias, 1MHz, 30mVAC	24	30	36	pF
C	Capacitance C1	At 2.5VDC Reverse Bias, 1MHz, 30mVAC		15		pF
V <sub>DIODE</sub>	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	1.0	μA
V <sub>SIG</sub>	Signal Clamp 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, 3 and 4	±30 ±15			kV kV
R <sub>DYN</sub>	Dynamic Resistance Positive Negative			2.3 0.9		Ω Ω
f <sub>R</sub>	Roll-off Frequency at -6dB Attenuation Z <sub>SOURCE</sub> =50Ω, Z <sub>LOAD</sub> =50Ω			350		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 (i.e. if ESD is applied to pin A1 then clamping voltage is measured at pin C1). Unused pins are left open.

Note 4: These parameters are guaranteed by design and characterization.

## Performance Information

Typical Filter Performance (T<sub>A</sub>=25°C, DC Bias=0V, 50 Ohm Environment)

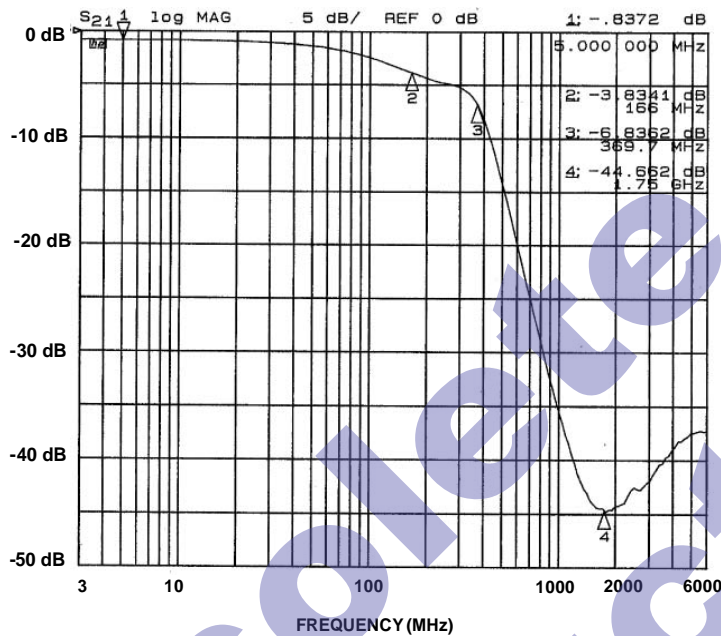


Figure 1. Typical EMI Filter Performance (4 Channel – Filter 1)

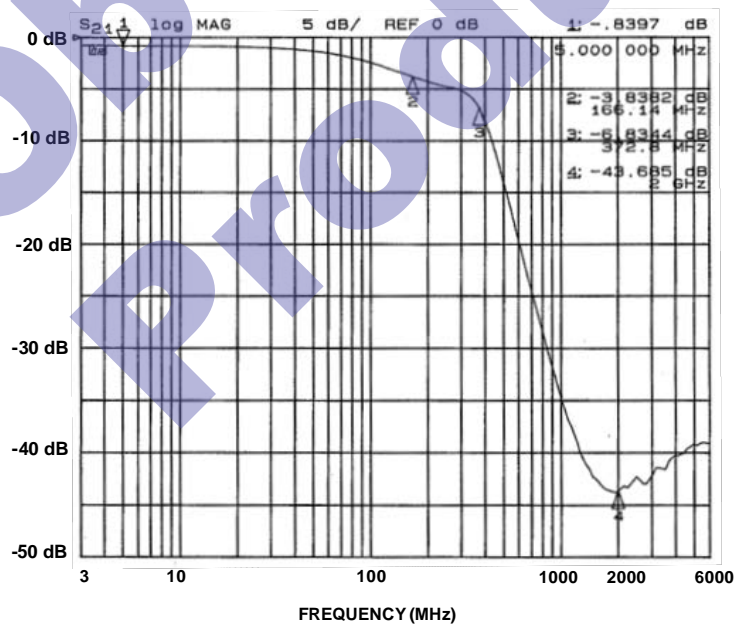


Figure 2. Typical EMI Filter Performance (4 Channel – Filter 2)

**Performance Information (cont'd)**

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

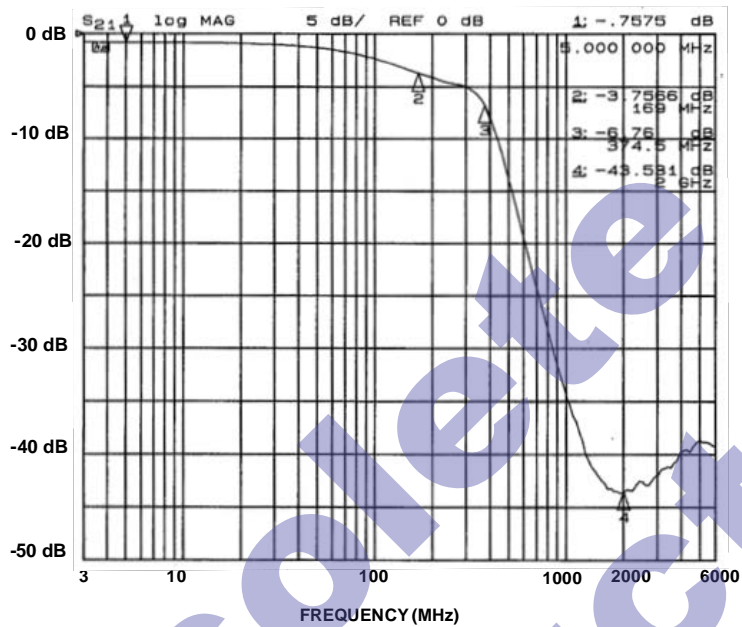


Figure 3. Typical EMI Filter Performance (4 Channel – Filter 3)

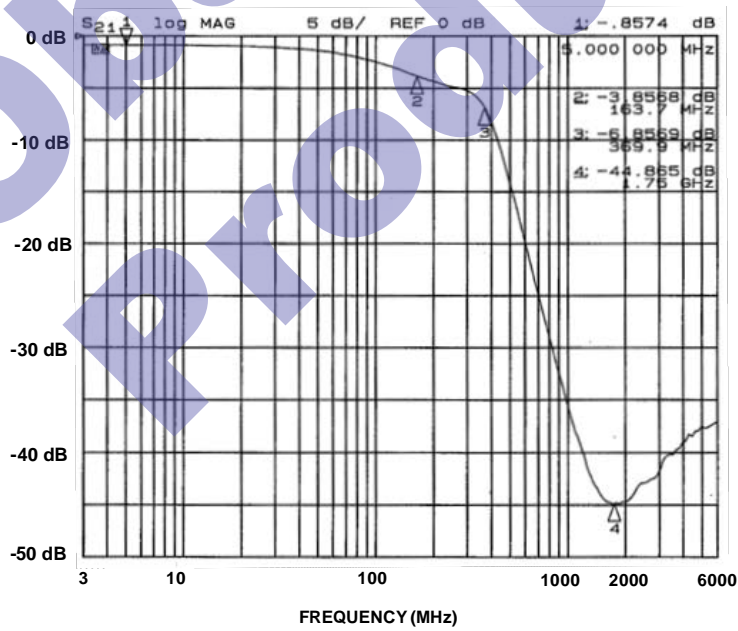


Figure 4. Typical EMI Filter Performance (4 Channel – Filter 4)

Typical Diode Capacitance vs. Input Voltage

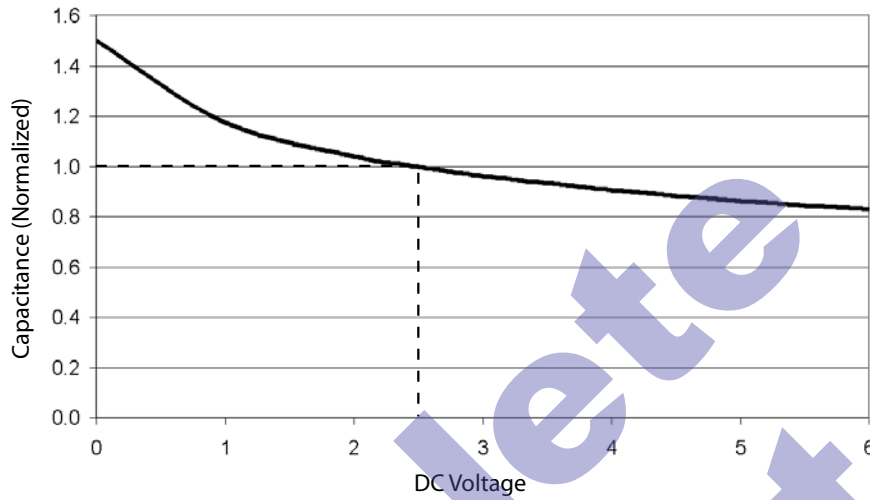


Figure 5. Filter Capacitance vs. Input Voltage (normalized to capacitance at 2.5VDC and 25°C)

Obsolete Product

## Mechanical Details

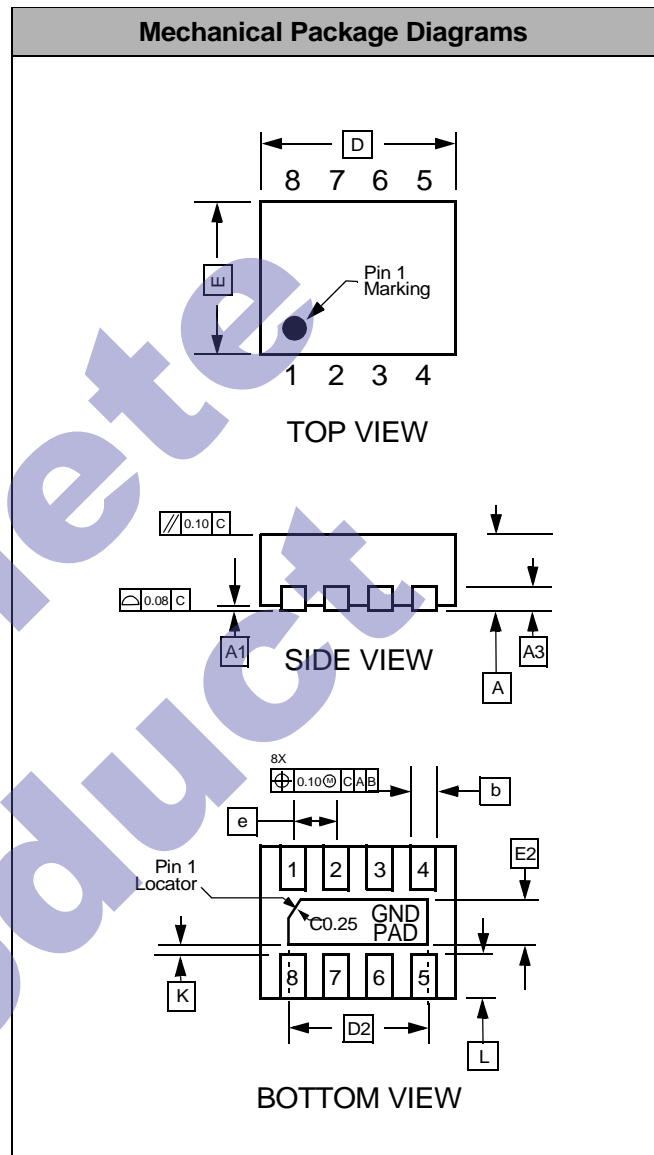
### uDFN-08 Mechanical Specifications

Dimensions for the CM1660-04DE supplied in an 8-lead, 0.5mm pitch uDFN package are presented below.

For complete information on the uDFN-12, see the California Micro Devices uDFN Package Information document.

PACKAGE DIMENSIONS						
Package	uDFN					
JEDEC No.	MO-229 (Var. VCCD-3)†					
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	0.20	0.25	0.30	0.008	0.010	0.012
D	1.90	2.00	2.10	0.075	0.079	0.083
D2	1.50	1.60	1.70	0.059	0.063	0.067
E	1.90	2.00	2.10	0.075	0.079	0.083
E2	0.80	0.90	1.00	0.031	0.035	0.039
e	0.50			0.020		
K	0.20			0.008		
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						

\*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, 0.5mm pitch uDFN Package

### Mechanical Details (cont'd)

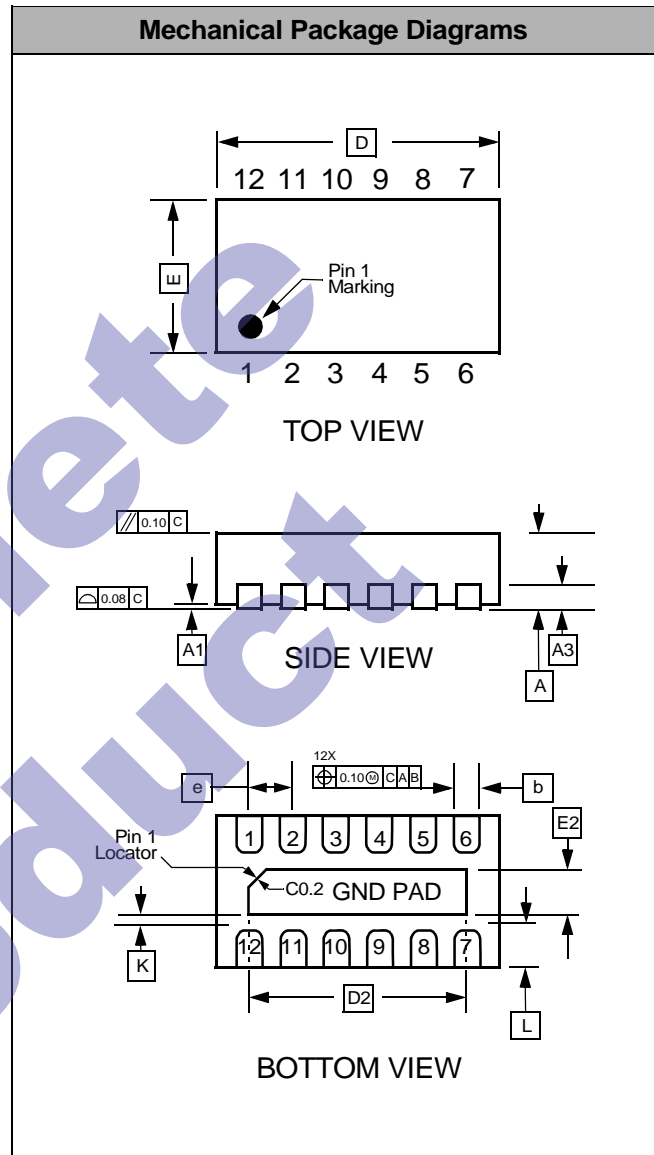
#### uDFN-12 Mechanical Specifications, 0.5mm

The CM1660-06D3 is supplied in an 12-lead, 0.5mm pitch uDFN package. Dimensions are presented below.

For complete information on the uDFN-12, see the California Micro Devices uDFN Package Information document.

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	0.20	0.25	0.30	0.008	0.010	0.012
D	2.90	3.00	3.10	0.114	0.118	0.122
D2	2.40	2.50	2.60	0.095	0.098	0.102
E	1.25	1.35	1.45	0.049	0.053	0.057
E2	0.35	0.40	0.45	0.014	0.016	0.018
e	0.50 BSC			0.020 BSC		
K	0.20			0.008		
L	0.20	0.25	0.30	0.008	0.010	0.012
# 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, 0.5mm pitch uDFN package

## Mechanical Details (cont'd)

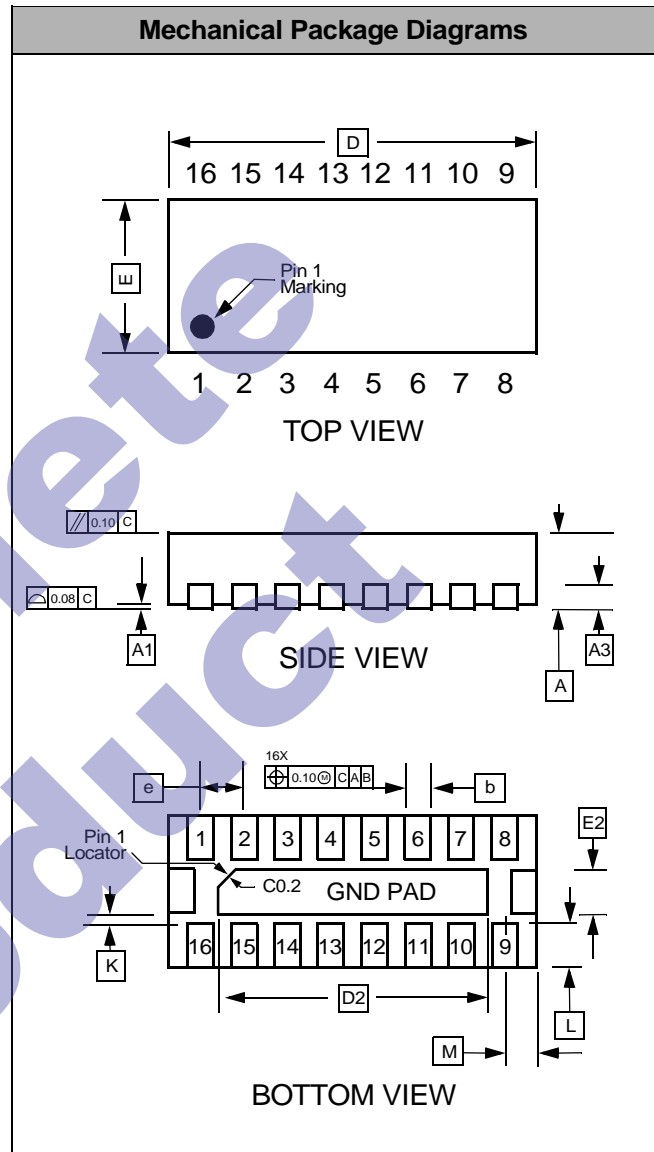
### uDFN Mechanical Specifications

The CM1660-DE is supplied in a 16-lead, 0.5mm pitch uDFN package with Exposed End Pads (EEP). Dimension are presented below.

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

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	0.20	0.25	0.30	0.008	0.010	0.012
D	3.90	4.00	4.10	0.153	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 BSC			0.020 BSC		
K	0.20			0.008		
L	0.20	0.30	0.40	0.008	0.010	0.012
M	0.25 REF			0.010 REF		
# 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, 0.5mm pitch uDFN package with Exposed End Pads (EEP)**