

## LCD and Camera EMI Filter Array with ESD Protection

### Features

- 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
- TDFN package with 0.50mm lead pitch:
  - 6-ch. = 12-lead TDFN
  - 8-ch. = 16-lead TDFN
- Tiny TDFN package size:
  - 12-lead: 3.0mm x 1.35mm (two styles)
  - 16-lead: 4.0mm x 1.60mm
- Increased robustness against vertical impacts during manufacturing process
- Lead-free finishing

### 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

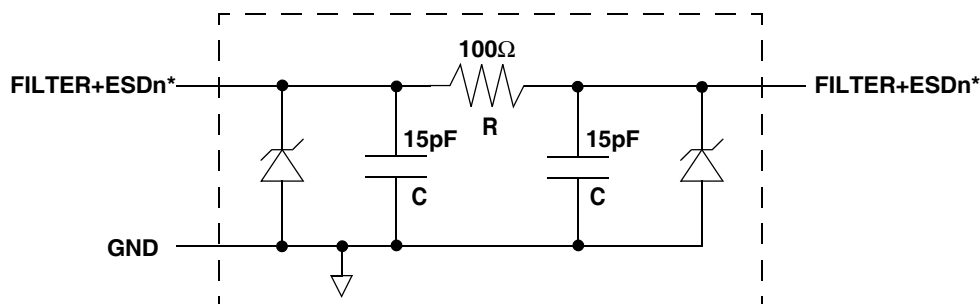
### Product Description

The CM1409 is a family of pi-style EMI filter arrays with ESD protection, which integrates six and eight filters (C-R-C) in small form factor TDFN 0.50mm pitch packages. The CM1409 has component values of 15pF-100Ω-15pF per channel. The CM1409 has a cut-off frequency of 110MHz and can be used in applications with data rates up to 44Mbps. The parts include ESD 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 protection diodes safely dissipate ESD strikes of ±15kV, well beyond the maximum requirement of the IEC61000-4-2 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 ±30kV.

These devices are particularly well-suited for portable electronics (e.g. wireless handsets, PDAs, notebook computers) because of their small package and easy-to-use pin assignments. In particular, the CM1409 is ideal for EMI filtering and protecting data and control lines for the I/O data ports, LCD display and camera interface in mobile handsets.

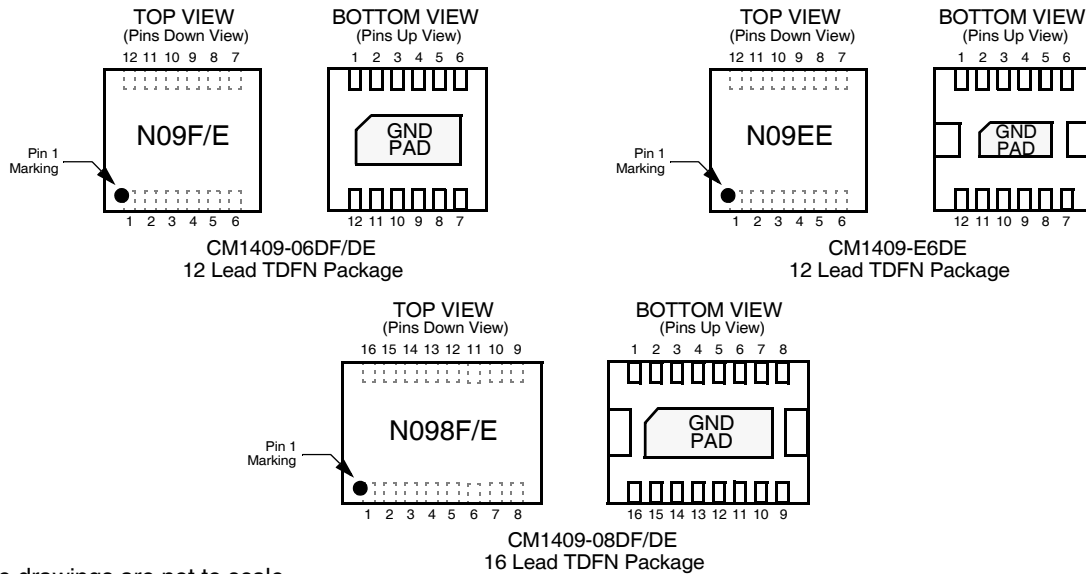
The CM1409 is housed in space-saving, low-profile 12- and 16-lead TDFN packages with a 0.50mm pitch and is available with lead-free finishing.

### Electrical Schematic



### 1 of 6 or 8 EMI/RFI + ESD Channels

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

**PACKAGE / PINOUT DIAGRAMS**

**PIN DESCRIPTIONS**

DEVICE PIN(s)		NAME	DESCRIPTION	DEVICE PIN(s)		NAME	DESCRIPTION
-06	-08			-06	-08		
1	1	FILTER1	Filter + ESD Channel 1	12	16	FILTER1	Filter + ESD Channel 1
2	2	FILTER2	Filter + ESD Channel 2	11	15	FILTER2	Filter + ESD Channel 2
3	3	FILTER3	Filter + ESD Channel 3	10	14	FILTER3	Filter + ESD Channel 3
4	4	FILTER4	Filter + ESD Channel 4	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	Standard Finish		Lead-free Finish	
		Ordering Part Number <sup>1</sup>	Part Marking	Ordering Part Number <sup>1</sup>	Part Marking
12	TDFN-12	-	-	CM1409-E6DE	N09EE
12	TDFN-12	CM1409-06DF	N09F	CM1409-06DE	N09E
16	TDFN-16	CM1409-08DF	N098F	CM1409-08DE	N098E

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	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
R	Resistance		80	100	120	Ω
C <sub>TOTAL</sub>	Total Channel Capacitance	At 2.5VDC Reverse Bias, 1MHz, 30mVAC	24	30	36	pF
C	Capacitance C <sub>1</sub>	At 2.5VDC Reverse Bias, 1MHz, 30mVAC	12	15	18	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 and 3	±30 ±15			kV kV
R <sub>DYN</sub>	Dynamic Resistance Positive Negative			2.3 0.9		Ω Ω
f <sub>C</sub>	Cut-off Frequency Z <sub>SOURCE</sub> =50Ω, Z <sub>LOAD</sub> =50Ω	Channel R = 100Ω, Channel C = 15pF		110		MHz
A <sub>1GHz</sub>	Absolute Attenuation @ 1GHz from 0dB Level	Z <sub>SOURCE</sub> = 50Ω, Z <sub>LOAD</sub> = 50Ω, DC Bias = 0V; Notes 1, 4 and 5		35		dB
A <sub>800MHz - 6GHz</sub>	Absolute Attenuation @ 800MHz to 6GHz from 0dB Level	Z <sub>SOURCE</sub> = 50Ω, Z <sub>LOAD</sub> = 50Ω, DC Bias = 0V; Notes 1, 4 and 5		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: These parameters are guaranteed by design and characterization.

Note 4: Attenuation / RF curves characterized by a network analyzer using microprobes.

Note 5: These parameters are NOT guaranteed by design, characterization and production.

**Performance Information**

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

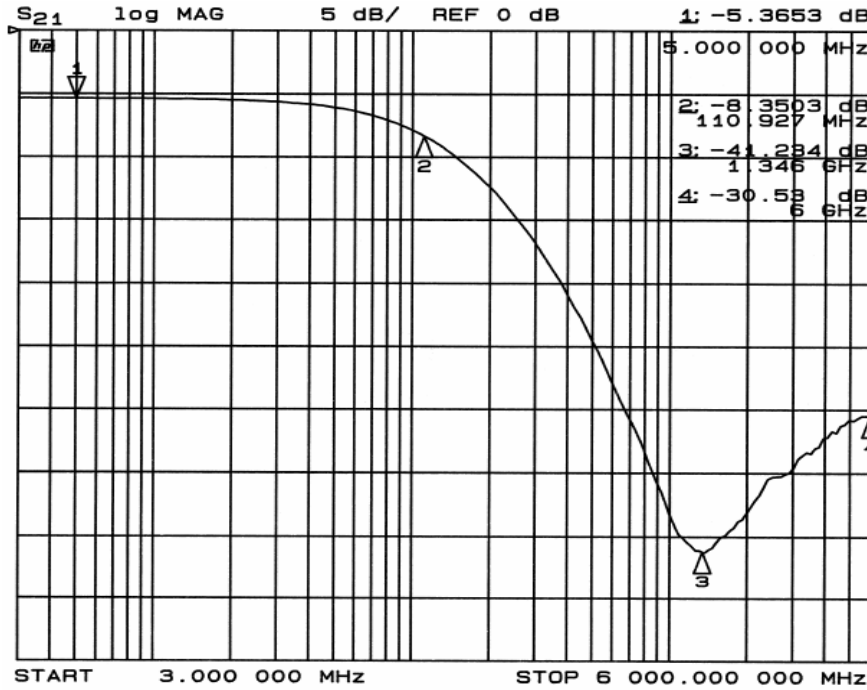


Figure 1. Insertion Loss vs. Frequency (Filter Input to GND)

**Typical Diode Capacitance vs. Input Voltage**

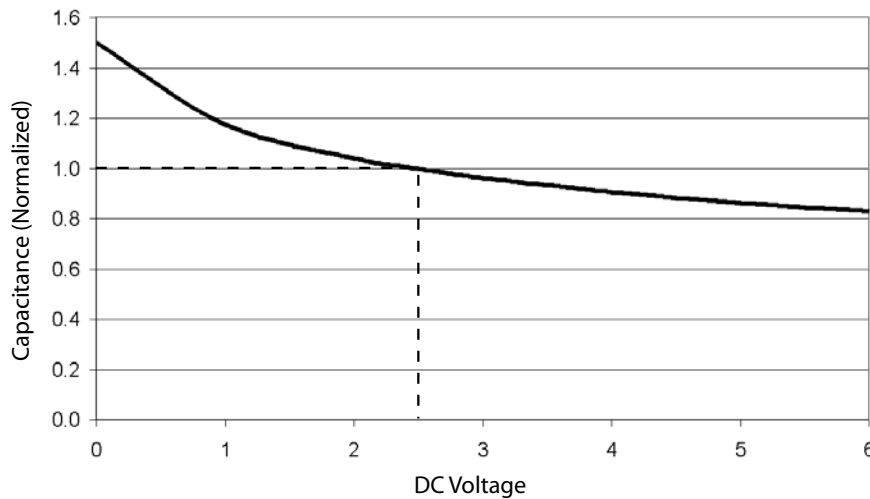


Figure 2. Filter Capacitance vs. Input Voltage (normalized to capacitance at 2.5VDC and 25°C)

## Mechanical Details

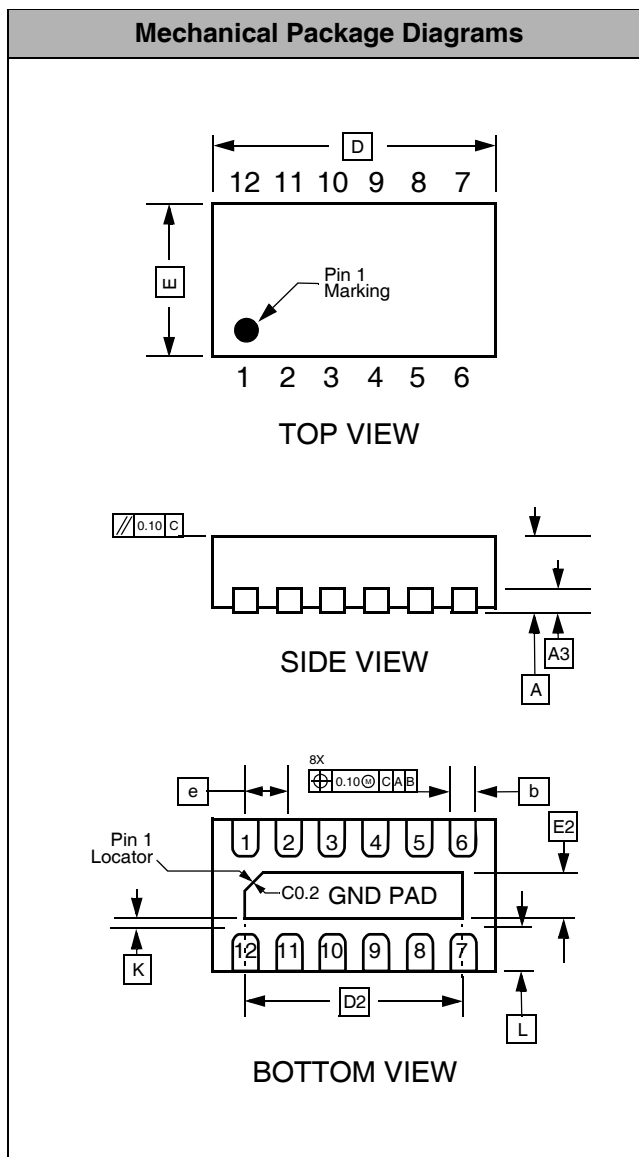
### TDFN-12 Mechanical Specifications

The CM1409-06DF/DE is supplied in an 12-lead, 0.5mm pitch TDFN package. Dimensions are presented below.

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

PACKAGE DIMENSIONS						
Package	TDFN					
JEDEC No.	MO-229C <sup>†</sup>					
Leads	12					
Dim.	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A	0.70	0.75	0.80	0.028	0.030	0.031
A3	0.20 REF			0.008 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						

<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.



**Dimensions for 12-Lead, 0.5mm pitch TDFN package**

**Mechanical Details (cont'd)**

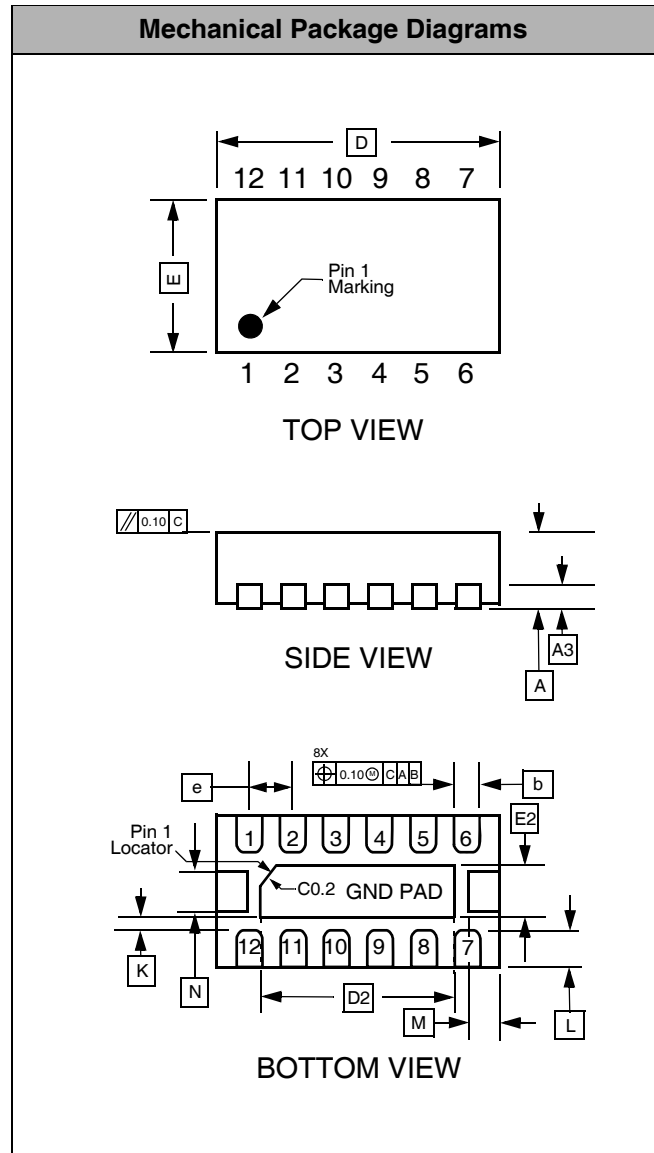
**TDFN-12 Mechanical Specifications**

The CM1409-E6DE is supplied in an 12-lead, 0.5mm pitch TDFN package. Dimensions are presented below.

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

PACKAGE DIMENSIONS						
Package	TDFN					
JEDEC No.	MO-229C <sup>†</sup>					
Leads	12					
Dim.	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A	0.70	0.75	0.80	0.028	0.030	0.031
A3	0.20 REF			0.008 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	2.10	2.20	2.30	0.083	0.087	0.091
E	1.25	1.35	1.45	0.049	0.053	0.057
E2	0.25	0.30	0.35	0.008	0.012	0.014
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
M	0.20 REF			0.008 REF		
N	0.25 REF			0.010 REF		
# 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.



**Dimensions for 12-Lead, 0.5mm pitch TDFN package**

**Mechanical Details (cont'd)**

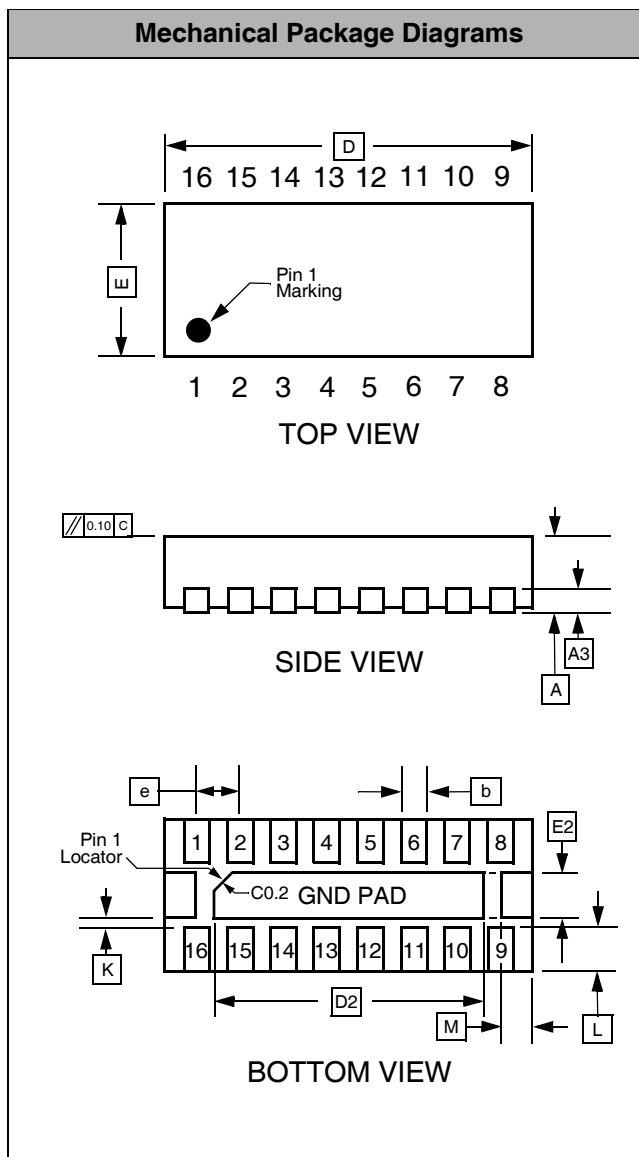
**TDFN-16 Mechanical Specifications**

The CM1409-08DE/DF is supplied in an 16-lead, 0.5mm pitch TDFN package. Dimensions 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
<b>A</b>	0.70	0.75	0.80	0.028	0.030	0.031
<b>A3</b>	0.20 REF			0.008 REF		
<b>b</b>	0.20	0.25	0.30	0.008	0.010	0.012
<b>D</b>	3.90	4.00	4.10	0.153	0.157	0.161
<b>D2</b>	3.10	3.20	3.30	0.122	0.126	0.130
<b>E</b>	1.50	1.60	1.70	0.059	0.063	0.067
<b>E2</b>	0.30	0.40	0.50	0.012	0.016	0.020
<b>e</b>	0.50 BSC			0.020 BSC		
<b>K</b>	0.20			0.008		
<b>L</b>	0.20	0.30	0.40	0.008	0.010	0.012
<b>M</b>	0.25 REF			0.010 REF		
<b># per tape and reel</b>	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.



**Dimensions for 16-Lead, 0.5mm pitch TDFN package**

Cirek POD-CEC-DFN16-013 4.00x1.60mm, 0.5mm pitch 16L TDFN