

***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
- $\pm 15\text{kV}$ 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 20dB attenuation (typical) at 1 GHz
- TDFN package with 0.50mm lead pitch:
 - 4-ch. = 8-lead TDFN
 - 6-ch. = 12-lead TDFN
 - 8-ch. = 16-lead TDFN
- Tiny TDFN package size:
 - 8-lead: 2.00mm 2.00mm
 - 12-lead: 3.00mm x 1.35mm
 - 16-lead: 4.00mm x 1.60mm
- Increased robustness against vertical impacts during manufacturing process
- Lead-free version available

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

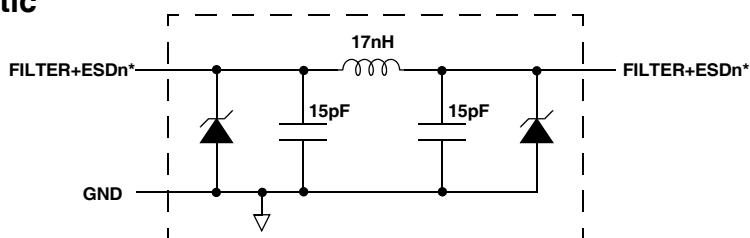
Product Description

California Micro Devices' CM1460 is a family of pi-style EMI filter arrays with ESD protection, which integrates four, six and eight filters (C-L-C) in small form factor TDFN 0.50mm pitch packages. Each EMI filter channel of the CM1460 is implemented as a 3-pole L-C filter where the component values are 15pF-17nH-15pF. The CM1460's roll-off frequency at -6dB attenuation is 350MHz and can be used in applications where the data rates are as high as 140Mbps while providing greater than 30dB over the 800MHz to 2.7GHz frequency range. 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 connected to the filter ports are designed and characterized to safely dissipate ESD strikes of $\pm 15\text{kV}$, 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 $\pm 30\text{kV}$.

This device is particularly well suited for wireless handsets, mobile LCD modules and PDAs because of its small package format and easy-to-use pin assignments. In particular, the CM1460 is ideal for EMI filtering and protecting data and control lines for the LCD display and camera interface in mobile handsets.

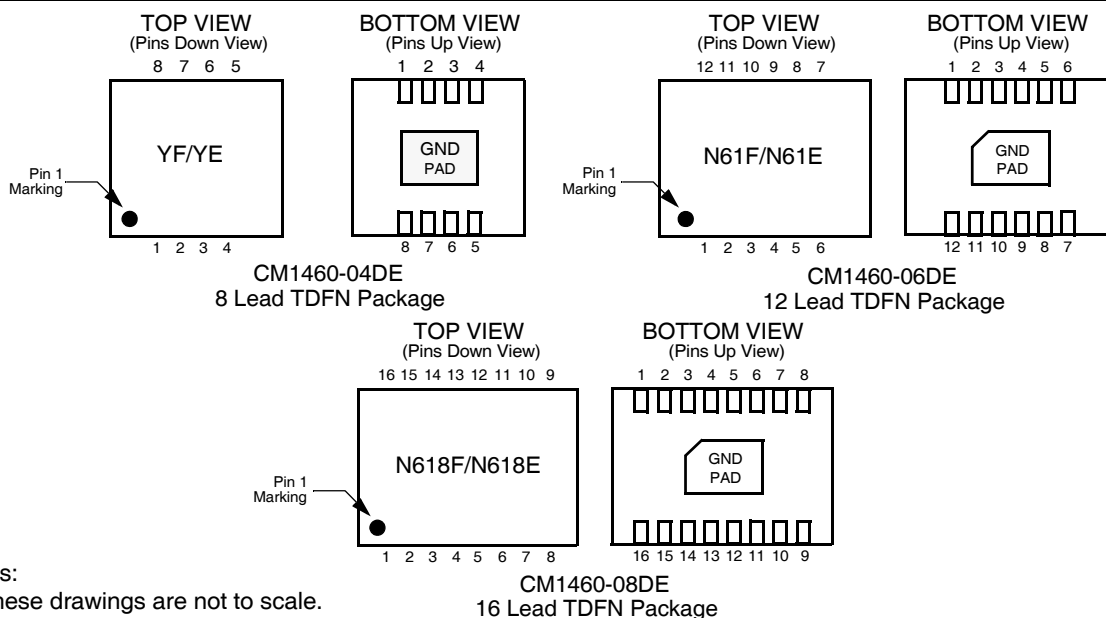
The CM1460 is housed in space saving, low profile 8, 12 and 16-lead TDFN packages where the pitch is 0.50mm and is available in lead-free format.

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 ¹	Part Marking
8	TDFN-8	CM1460-04DE	YE
12	TDFN-12	CM1460-06DE	N61E
16	TDFN-16	CM1460-08DE	N618E

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 _{TOTAL}	Total Channel Capacitance	At 2.5VDC Reverse Bias, 1MHz, 30mVAC	24	30	36	pF
C	Capacitance C1	At 2.5VDC Reverse Bias, 1MHz, 30mVAC	12	15	18	pF
V _{DIODE}	Standoff Voltage	I _{DIODE} =10μA		6.0		V
I _{LEAK}	Diode Leakage Current (reverse bias)	V _{DIODE} =+3.3V		0.1	1.0	μA
V _{SIG}	Signal Clamp Voltage Positive Clamp Negative Clamp	I _{LOAD} = 10mA I _{LOAD} = -10mA	5.6 -1.5	6.8 -0.8	9.0 -0.4	V V
V _{ESD}	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 _{DYN}	Dynamic Resistance Positive Negative			2.3 0.9		Ω Ω
f _C	Roll-off Frequency at 06dB Attenuation Z _{SOURCE} =50Ω, Z _{LOAD} =50Ω			350		MHz

Note 1: T_A=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 ($T_A=25^\circ\text{C}$, DC Bias=0V, 50 Ohm Environment)

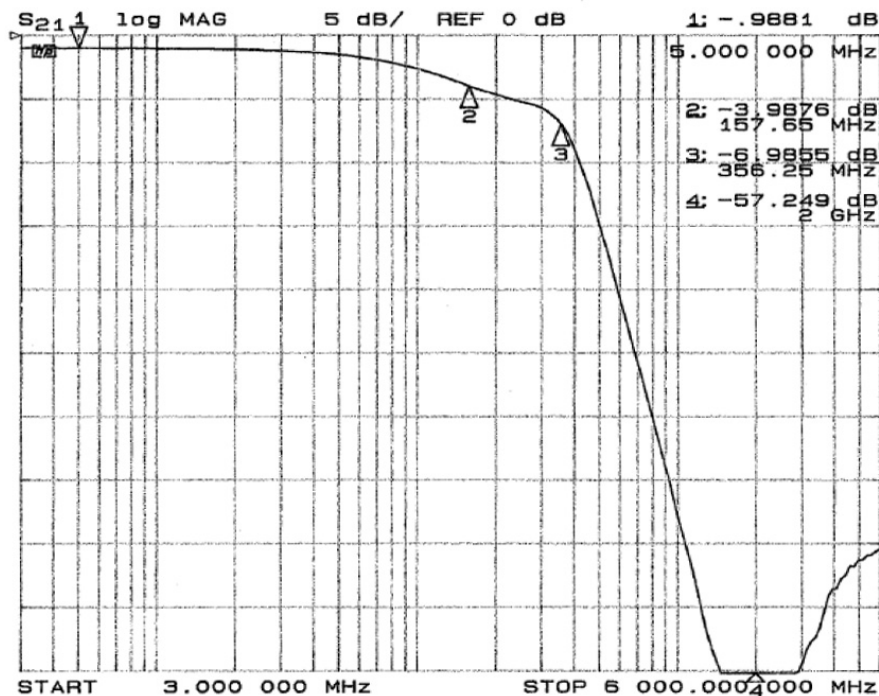
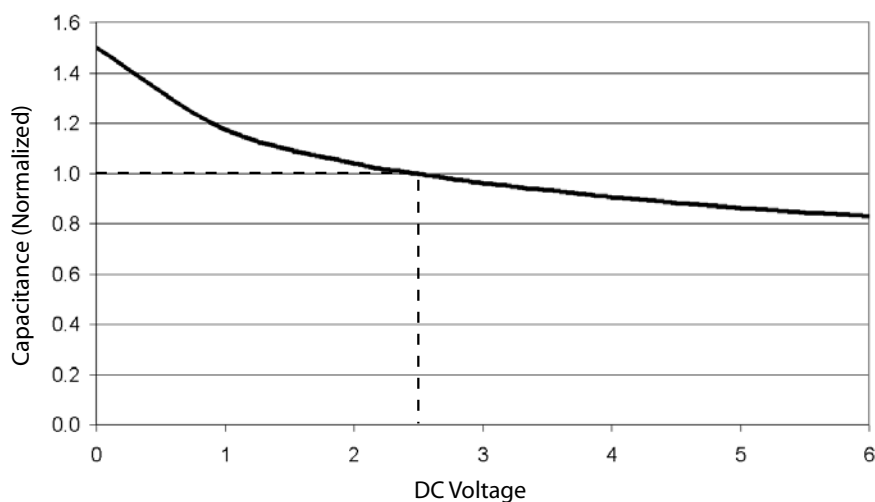


Figure 1. Typical EMI Filter Performance

Typical Diode Capacitance vs. Input Voltage



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

Mechanical Details

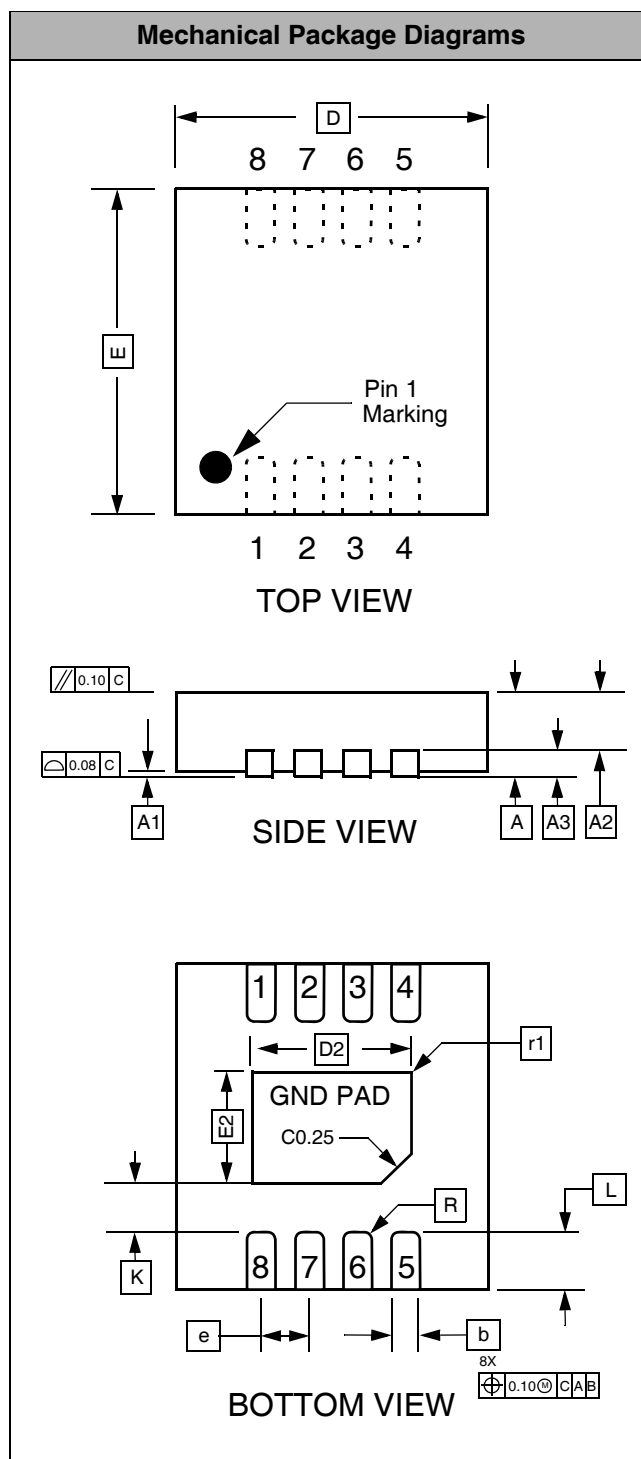
TDFN-08 Mechanical Specifications

The CM1460-04DE is supplied in an 8-lead, 0.5mm pitch TDFN package. Dimensions 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) [†]					
Leads	8					
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	0.55	0.65	0.80	0.022	0.026	0.031
A3		0.20			0.008	
b	0.20	0.25	0.30	0.008	0.010	0.012
D		2.00			0.079	
D2	1.50	1.60	1.70	0.059	0.063	0.067
E		2.00			0.079	
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
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						

[†]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, 0.5mm pitch TDFN Package

Mechanical Details (cont'd)

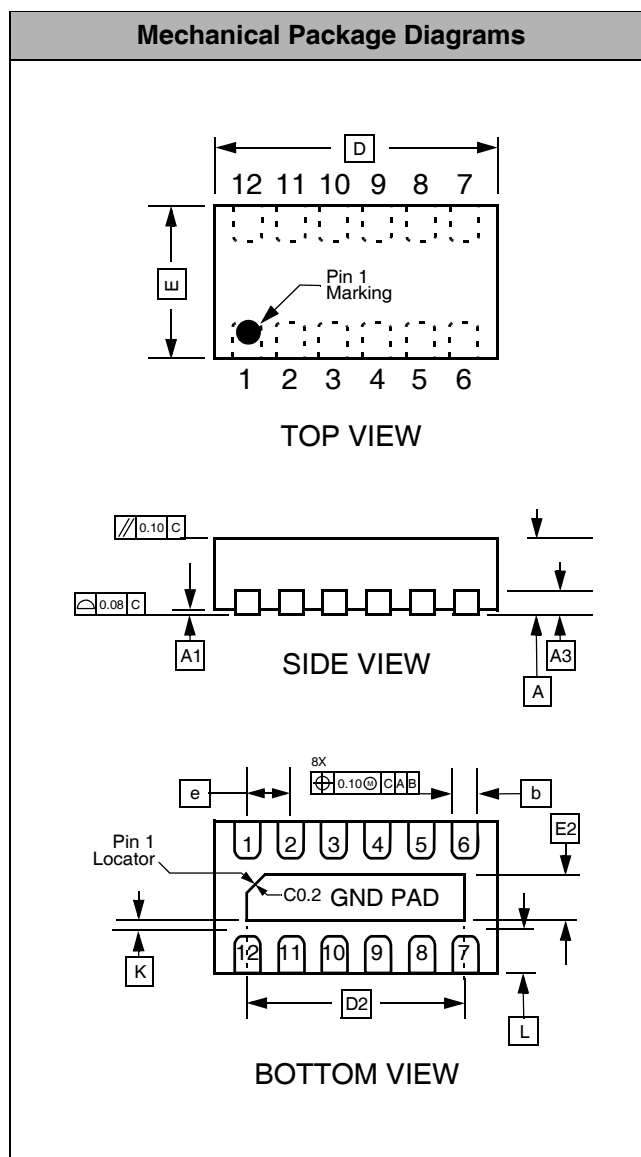
TDFN-12 Mechanical Specifications

The CM1460-06DE 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 [†]					
Leads	12					
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
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	0.30	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	0.25	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 TDFN package

Mechanical Details (cont'd)

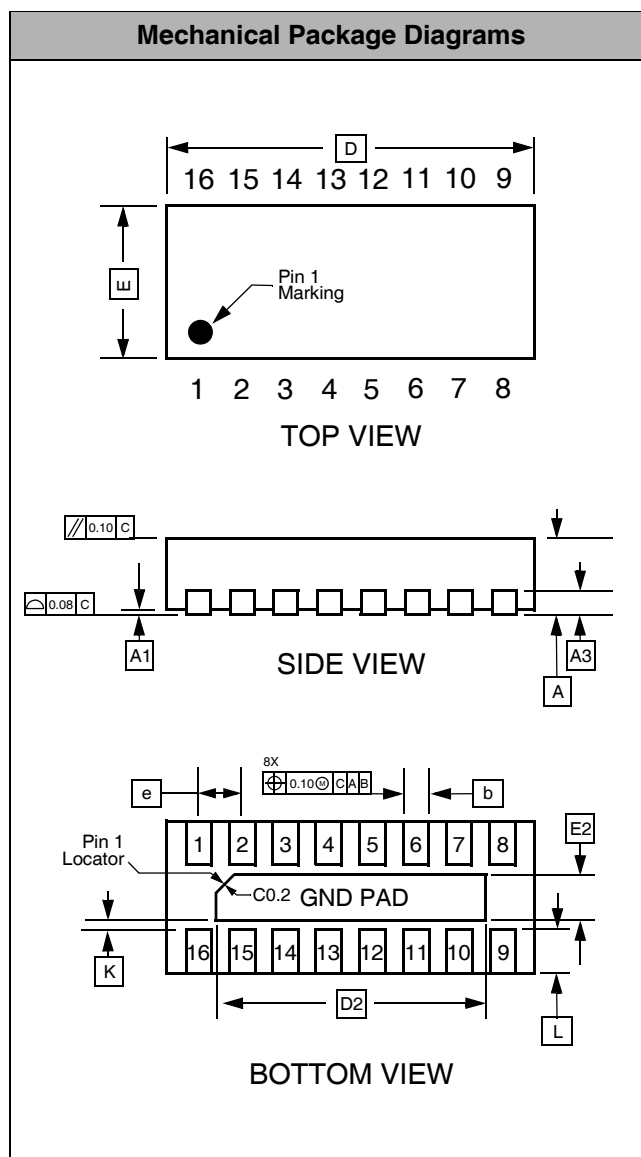
TDFN-16 Mechanical Specifications

The CM1460-08DE 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 [†]					
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
A3	0.40	0.55	0.70	0.016	0.022	0.028
b	0.20 REF			0.008 REF		
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			BSC		
K	0.20			0.008		
L	0.20	0.30	0.40	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 16-Lead, 0.5mm pitch TDFN package