



Praetorian® C-L-C LCD and Camera EMI FilterArray with ESD Protection

CM1461

Features

- Four, six, and eight channels of EMI filtering with integrated ESD protection
- Pi-style EMI filters in a capacitor-inductor-capacitor (C-L-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 1GHz
- TDFN lead-free 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 x 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 RoHS compliant 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

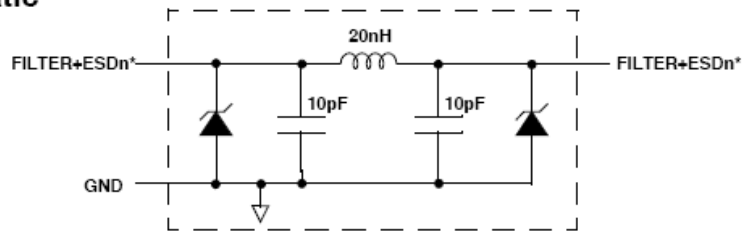
The CM1461 is a family of pi-style EMI filter arrays with ESD protection, which integrates four, six and eight filters (C-L-C) in small form factor TDFN 0.50mm pitch packages. Each EMI filter channel of the CM1461 is implemented as a 3-pole L-C filter where the component values are 10pF-20nH-10pF. The CM1461's roll-off frequency at -6dB attenuation is 400MHz 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 CM1461 is ideal for EMI filtering and protecting data and control lines for the LCD display and camera interface in mobile handsets.

The CM1461 is housed in space saving, low profile 8, 12 and 16-lead TDFN packages where the pitch is 0.50mm in a lead-free format.

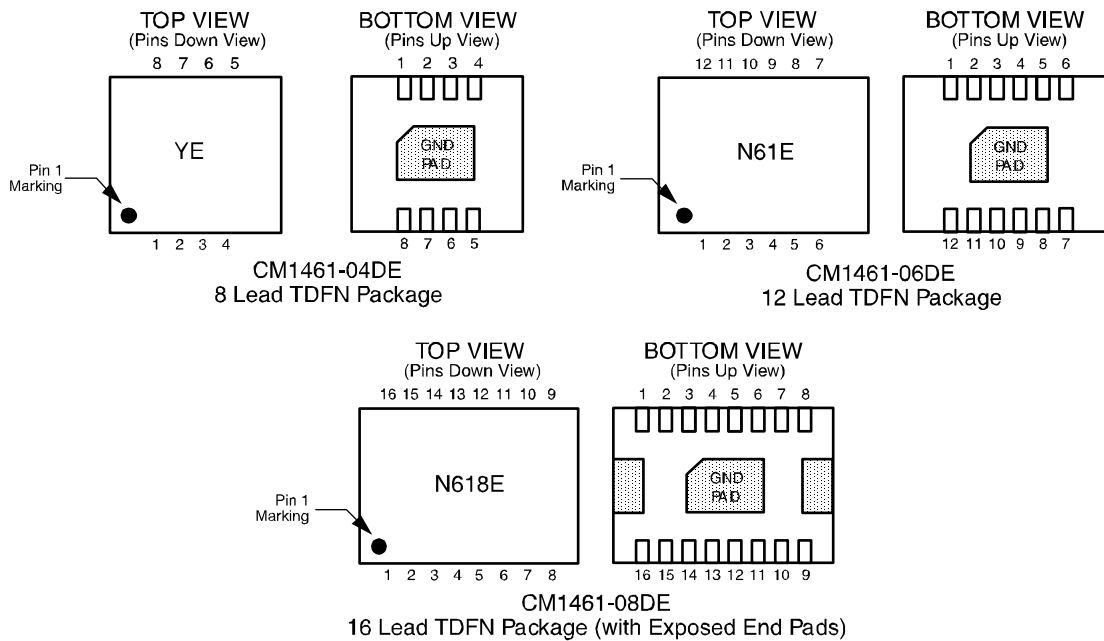
Electrical Schematic



* See Package/Pinout Diagram for expanded pin information.

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

PACKAGE / PINOUT DIAGRAMS



Notes:

1) These drawings are not to scale.

CM1461

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 | Ordering Part Number ¹ | Part Marking |
|------|-------------|-----------------------------------|--------------|
| 8 | TDFN-8 | CM1461-04DE | YE |
| 12 | TDFN-12 | CM1461-06DE | N61E |
| 16 | TDFN-16 EEP | CM1461-08DE | 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 | | | 20 | | nH |
| C _{TOTAL} | Total Channel Capacitance | At 2.5VDC Reverse Bias, 1MHz, 30mVAC | 16 | 20 | 24 | pF |
| C | Capacitance C1 | At 2.5VDC Reverse Bias, 1MHz, 30mVAC | | 10 | | 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 -0.4 | 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 and 3 | ±30 ±15 | | | kV kV |
| R _{DYN} | Dynamic Resistance Positive Negative | | | 2.3 0.9 | | Ω Ω |
| f _R | Roll-off Frequency at -6dB Attenuation Z _{SOURCE} =50Ω, Z _{LOAD} =50Ω | | | 400 | | 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.

Performance Information

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

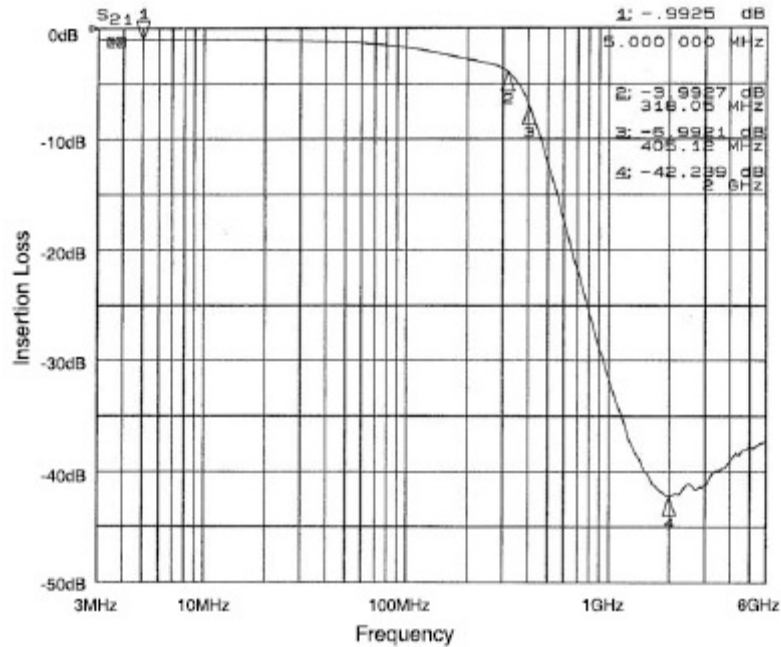


Figure 1. Filter 1 Insertion Loss (CM1461-04DE)

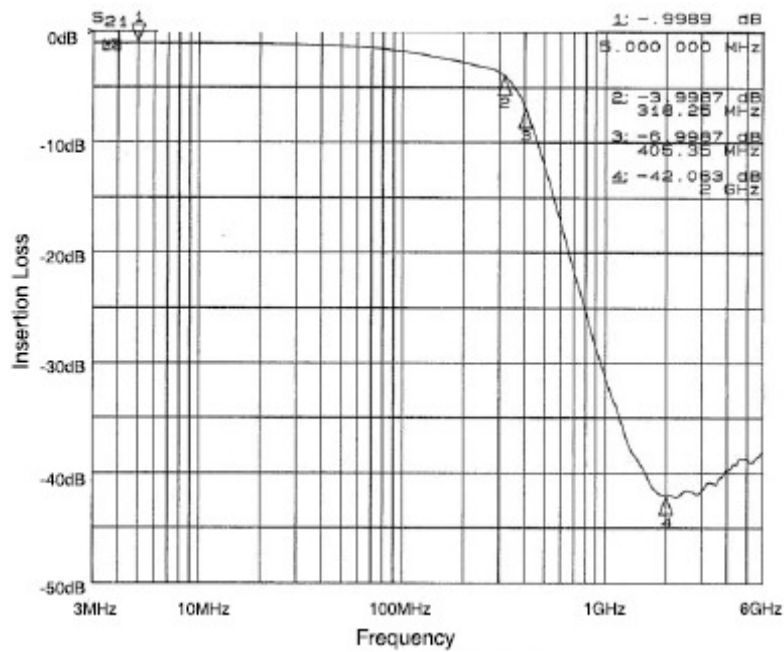


Figure 2. Filter 2 Insertion Loss (CM1461-04DE)

Performance Information (Cont'd)

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

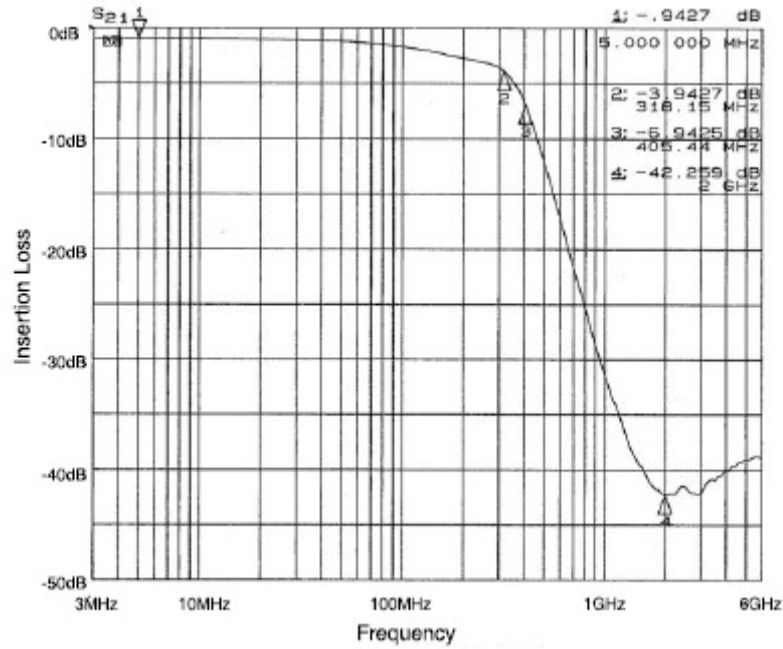


Figure 3. Filter 3 Insertion Loss (CM1461-04DE)

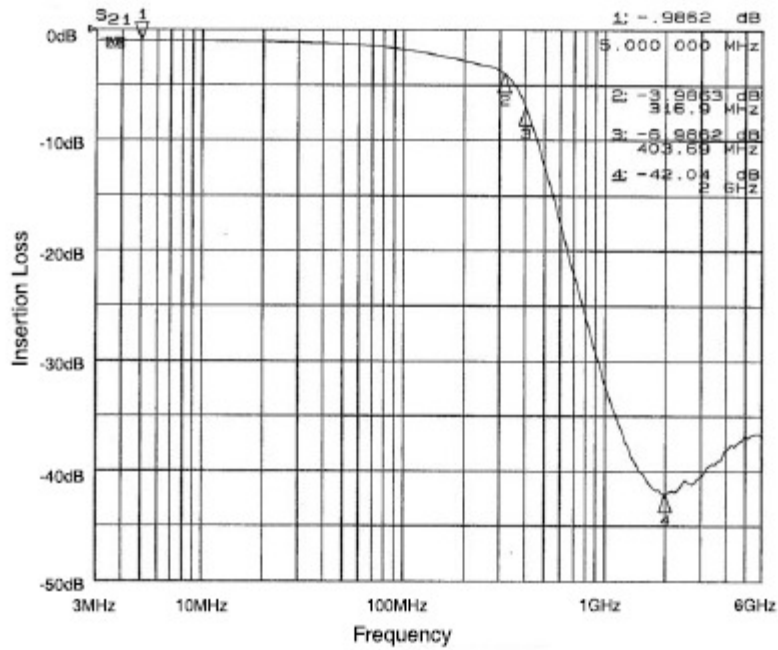


Figure 4. Filter 4 Insertion Loss (CM1461-04DE)

Performance Information

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

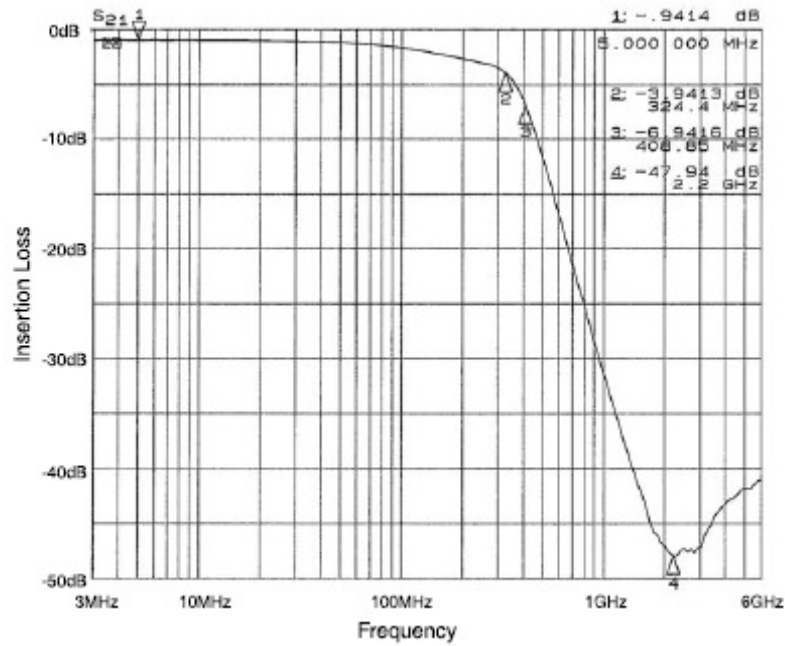


Figure 5. Filter 1 Insertion Loss (CM1461-06DE)

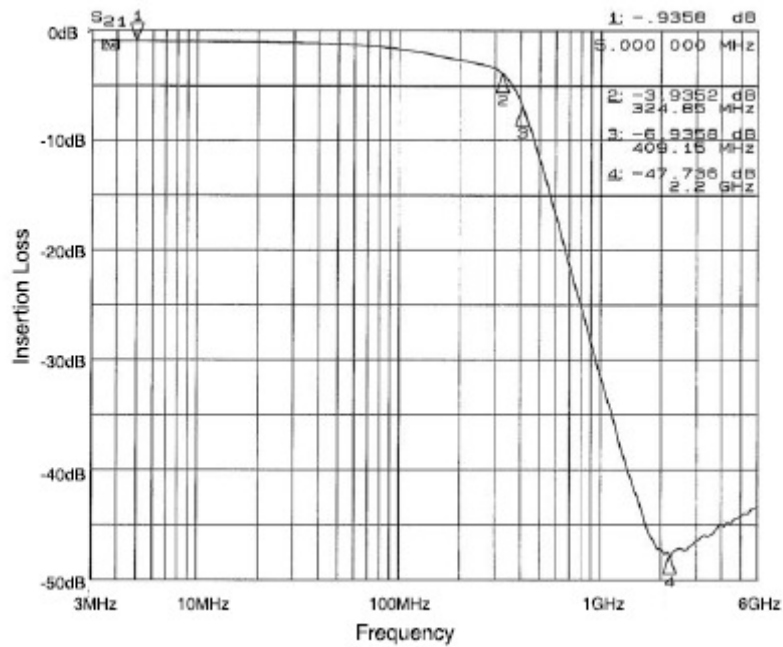


Figure 6. Filter 2 Insertion Loss (CM1461-06DE)

Performance Information

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

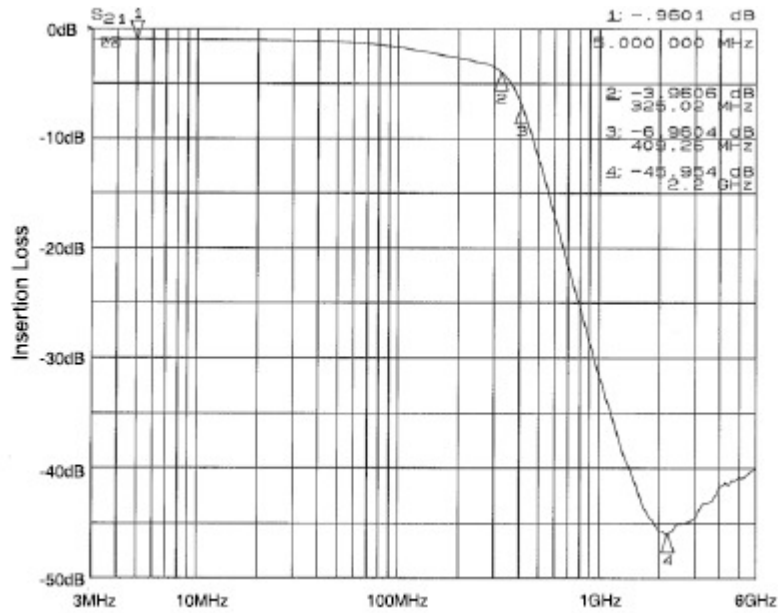


Figure 7. Filter 3 Insertion Loss (CM1461-06DE)

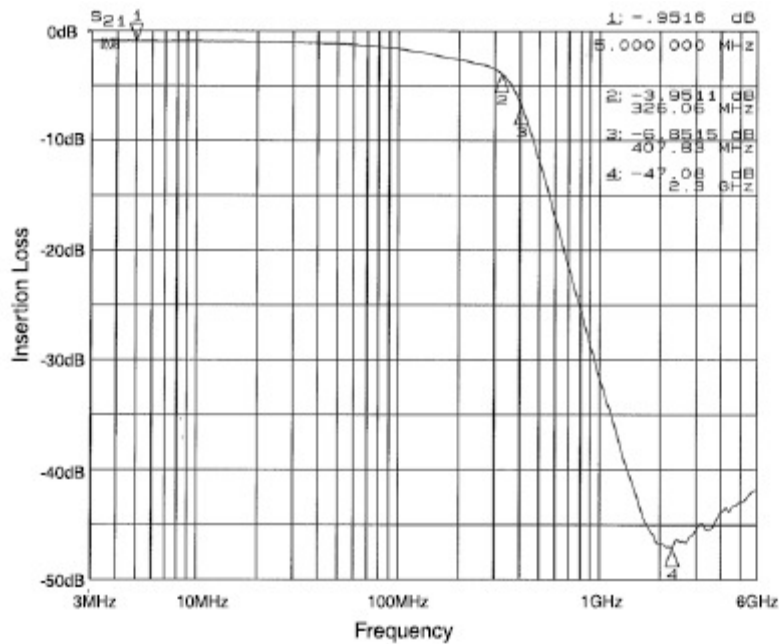


Figure 8. Filter 4 Insertion Loss (CM1461-06DE)

Performance Information

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

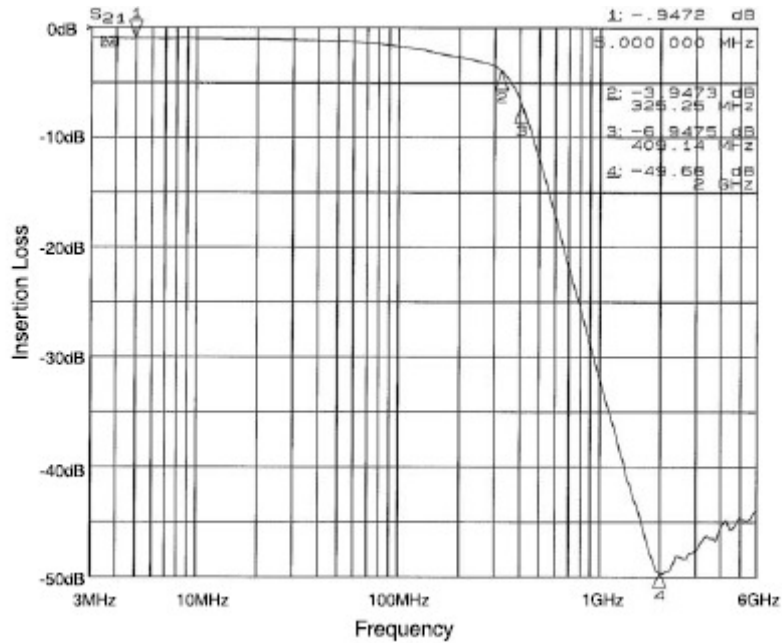


Figure 9. Filter 5 Insertion Loss (CM1461-06DE)

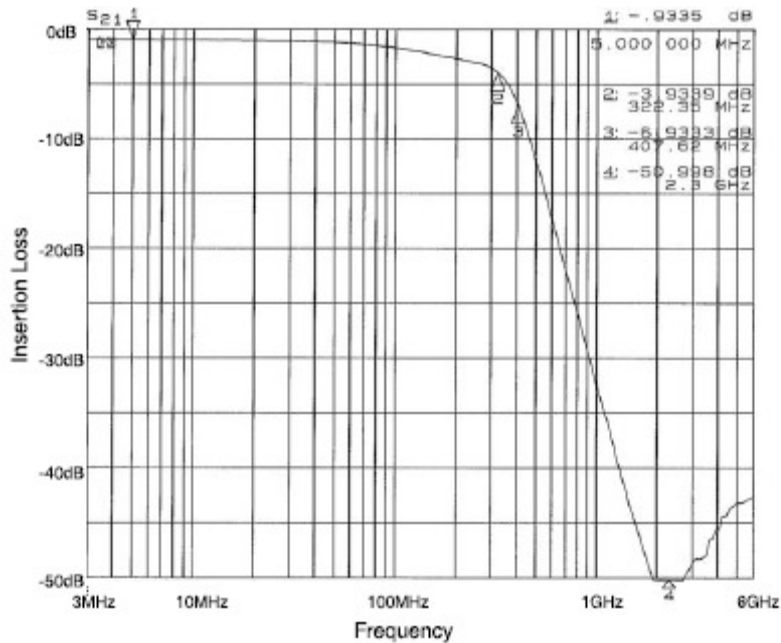


Figure 10. Filter 6 Insertion Loss (CM1461-06DE)

Performance Information

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

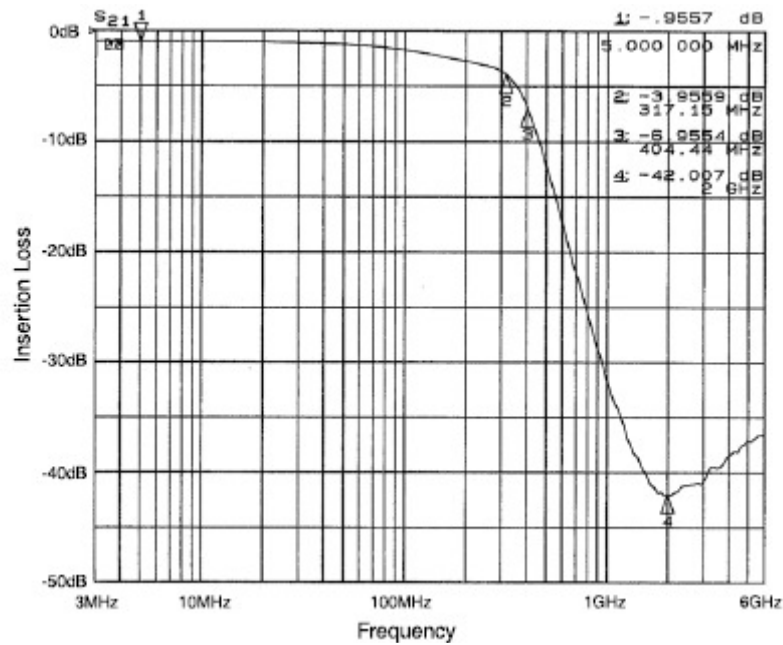


Figure 11. Filter 1 Insertion Loss (CM1461-08DE)

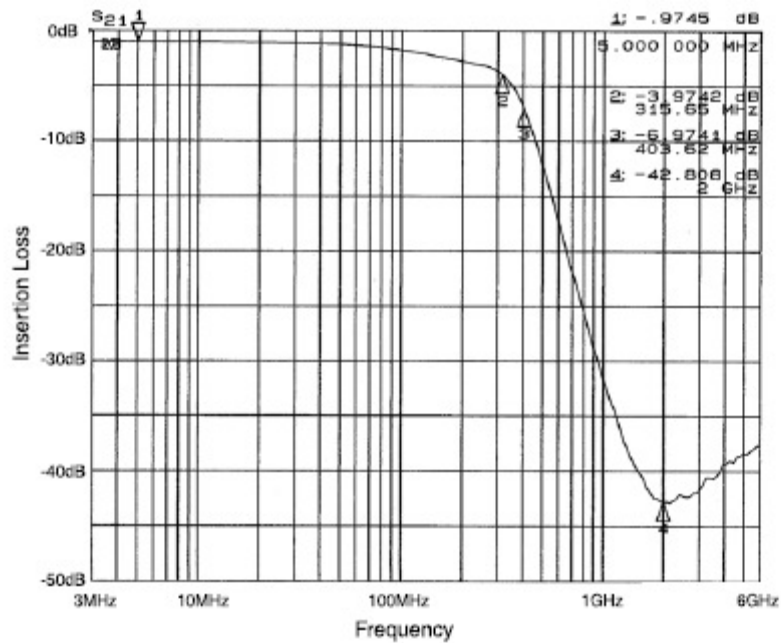


Figure 12. Filter 2 Insertion Loss (CM1461-08DE)

Performance Information

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

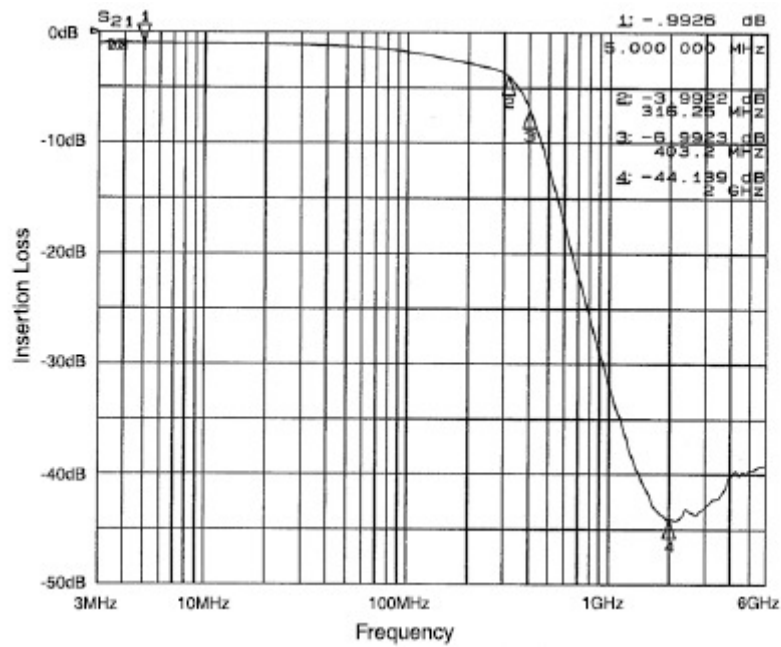


Figure 13. Filter 3 Insertion Loss (CM1461-08DE)

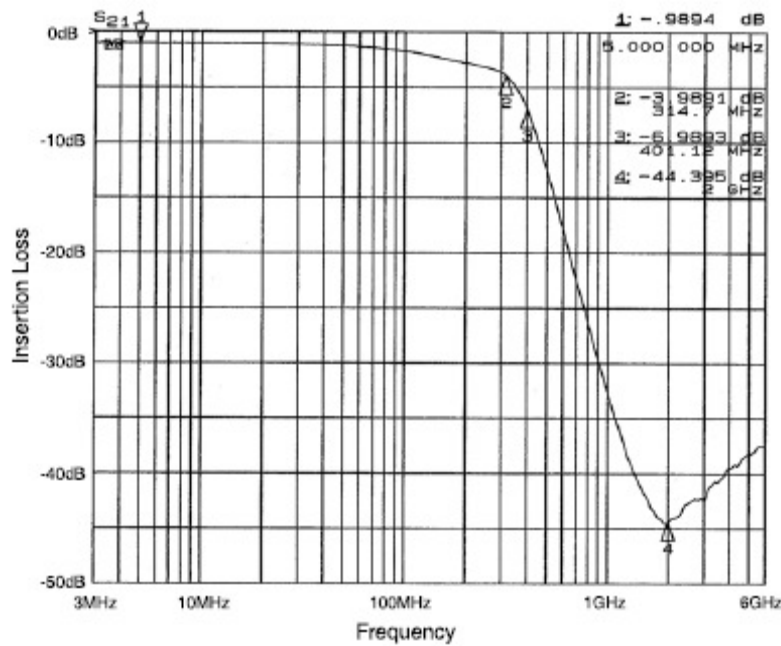


Figure 14. Filter 4 Insertion Loss (CM1461-08DE)

Performance Information

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

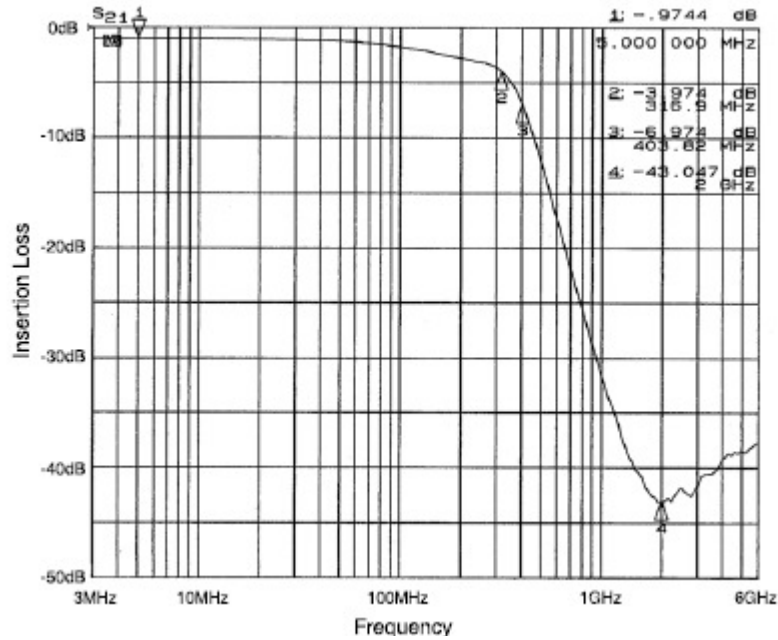


Figure 15. Filter 5 Insertion Loss (CM1461-08DE)

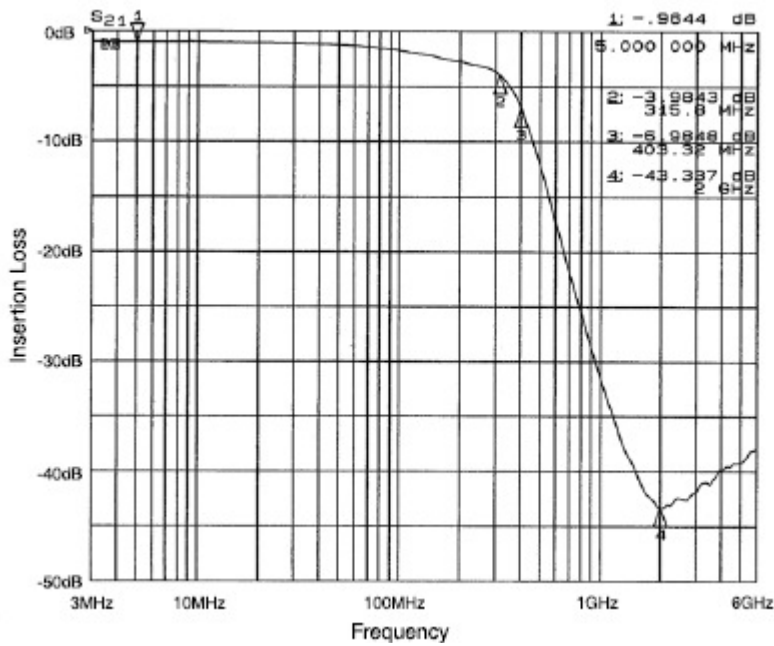


Figure 16. Filter 6 Insertion Loss (CM1461-08DE)

Performance Information

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

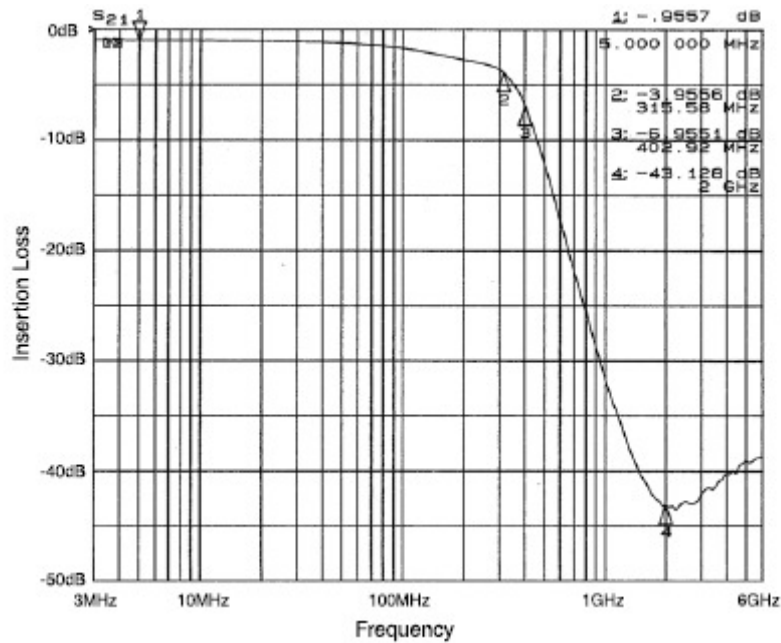


Figure 17. Filter 7 Insertion Loss (CM1461-08DE)

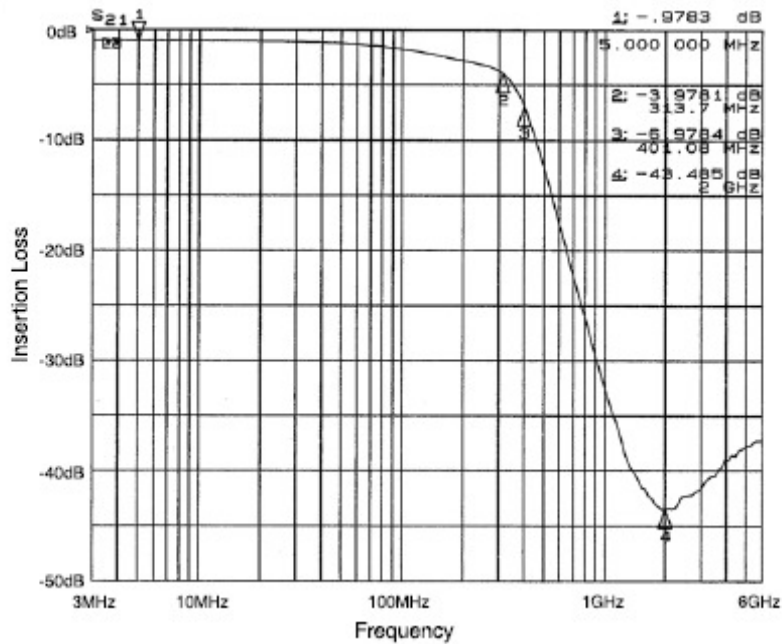
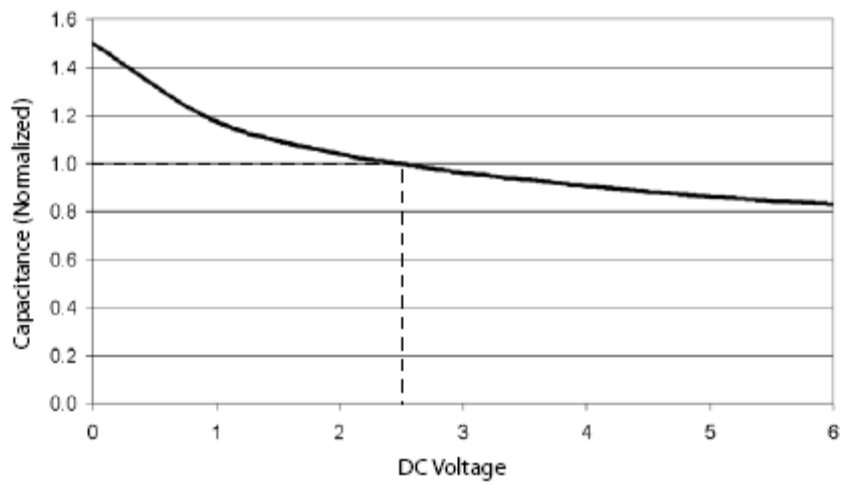


Figure 18. Filter 8 Insertion Loss (CM1461-08DE)

Typical Diode Capacitance vs. Input Voltage

**Figure 19. Filter Capacitance vs. Input Voltage
(normalized to capacitance at 2.5VDC and 25°C)**

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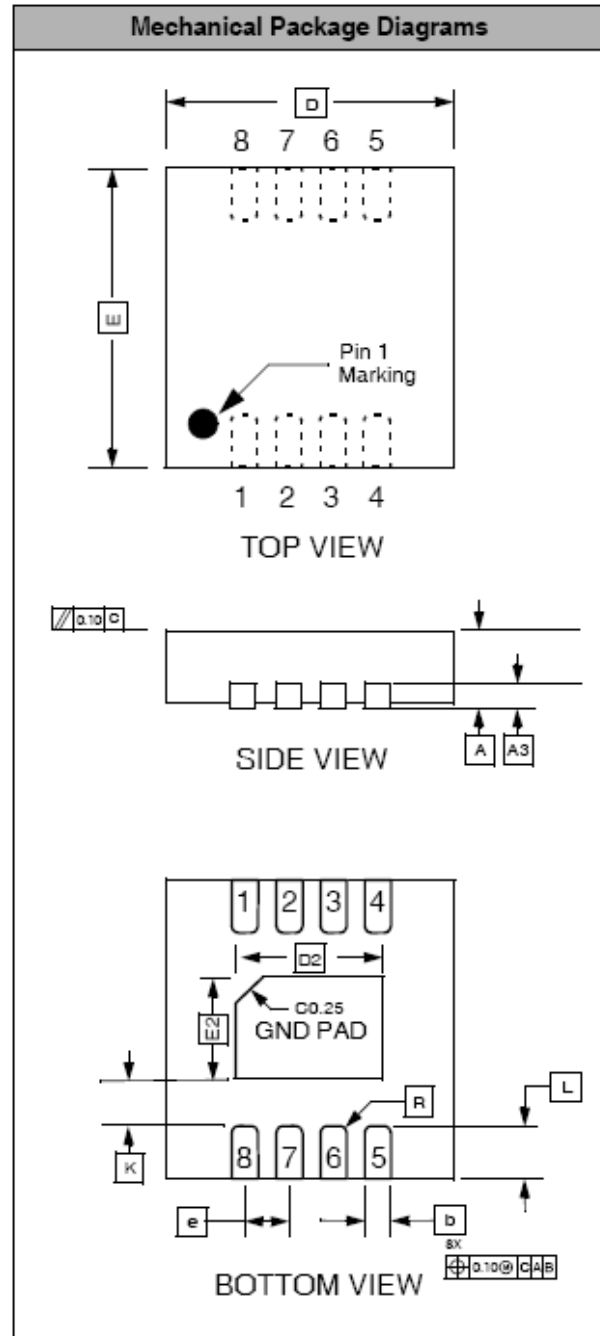
Mechanical Details

TDFN-08 Mechanical Specifications, 0.5mm

The CM1461-04DE is supplied in an 8-lead 0.5mm TDFN package. Dimensions are presented below.

| 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 |
| A3 | 0.20 REF | | | 0.008 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 BSC | | | 0.020 BSC | | |
| K | 0.20 | | | 0.008 | | |
| L | 0.20 | 0.30 | 0.40 | 0.008 | 0.012 | 0.016 |
| # 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.



Dimensions for 8-Lead, 0.5mm pitch TDFN Package

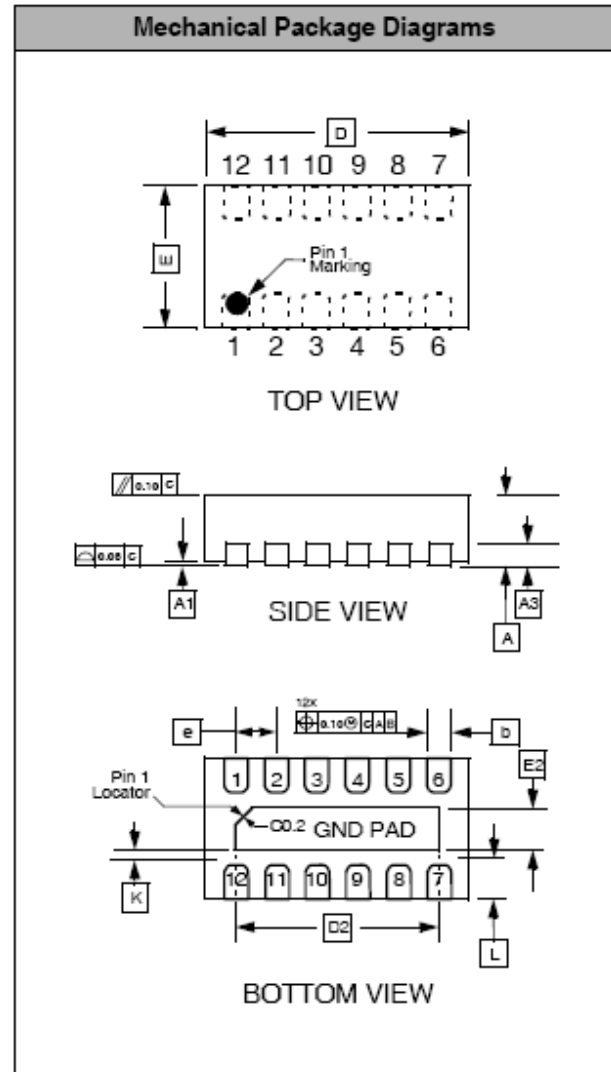
Mechanical Details

TDFN-12 Mechanical Specifications, 0.5mm

The CM1461-06DE is supplied in an 12-lead, 0.5mm pitch TDFN package. Dimensions are presented below.

| 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

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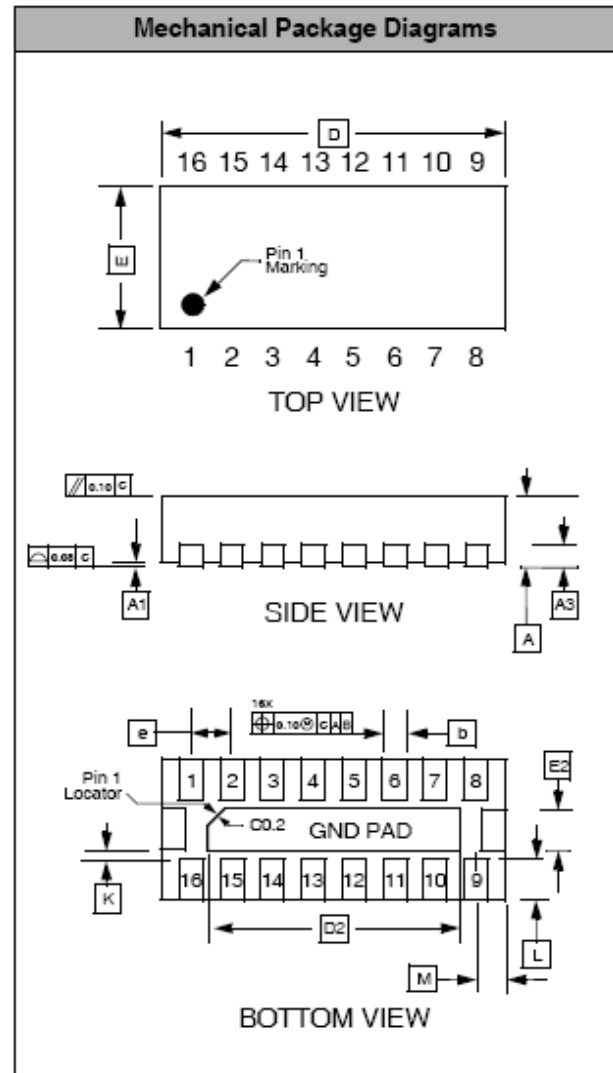
Mechanical Details (Cont'd)

TDFN-16EEP Mechanical Specifications, 0.5mm


The CM1461-08DE is supplied in a 16-lead, 0.5mm pitch TDFN package with Exposed End Pads (EEP). Dimension are presented below.

| 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 | 0.20 REF | | | 0.008 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 TDFN package with Exposed End Pads (EEP)

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