# CM1406

# 4 and 8-Channel EMI Filter Arrays with ESD Protection

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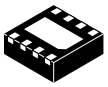
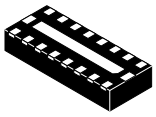


WDFN8
DE SUFFIX
CASE 511BE



WDFN16
DE SUFFIX
CASE 511AU

## Product Description

The CM1406 is an EMI filter array with ESD protection, which integrates either four or eight pi filters (C−R−C). Each CM1406 filter has component values of 15 pF – 200 Ω – 15 pF. These parts include ESD protection diodes on every pin, providing 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 safely dissipate ESD strikes of ±15 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 ±30 kV.

This device is particularly well suited for portable electronics (e.g. mobile handsets, PDAs, notebook computers) because of its small package 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 space−saving, low−profile, 8−lead and 16−lead WDFN packages. It is fabricated with *Centurion*™ process and available with lead−free finishing.

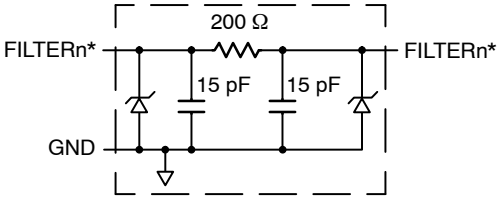
## Features

- Four and Eight Channels of EMI Filtering with ESD Protection
- Greater than 30 dB of Attenuation from 800 MHz to 3 GHz
- ±15 kV ESD Protection (IEC 61000−4−2, Contact Discharge)
- ±30 kV ESD Protection (HBM)
- Fabricated with *Centurion*™ Advanced Low Capacitance Zener Process Technology
- Space Saving, Low−Profile 8 and 16−Lead WDFN Packages
- These Devices are Pb−Free and are RoHS Compliant

## 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, Camera and Chip−to−Chip Data Lines

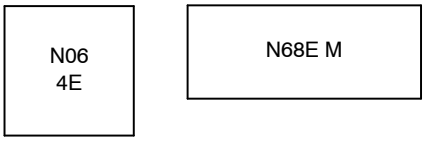
## BLOCK DIAGRAM




1 of 4/8 EMI Filtering + ESD Channels

*See Package/Pinout Diagrams for Expanded Pin Information.

## MARKING DIAGRAM




N06 4E = CM1406−04DE
N68E = CM1406−08DE

## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| CM1406−04DE | WDFN8 (Pb−Free) | 3000/Tape & Reel |
| CM1406−08DE | WDFN16 (Pb−Free) | 3000/Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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March, 2011 − Rev. 3

Publication Order Number:
CM1406/D

## PACKAGE / PINOUT DIAGRAMS

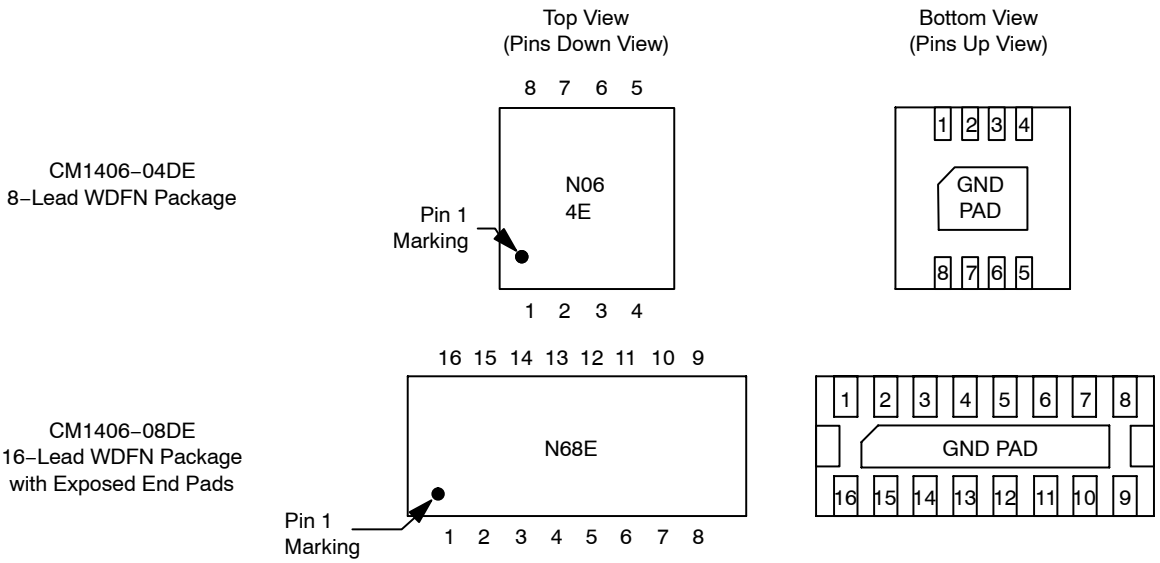



**Table 1. PIN DESCRIPTIONS**

| Pins | | Name | Description | Pins | | Name | Description |
|---|---|---|---|---|---|---|---|
| 1406−04Dx | 1406−08Dx | | | 1406−04Dx | 1406−08Dx | | |
| 1 | 1 | FILTER1 | Filter Channel 1 | 8 | 16 | FILTER1 | Filter Channel 1 |
| 2 | 2 | FILTER2 | Filter Channel 2 | 7 | 15 | FILTER2 | Filter Channel 2 |
| 3 | 3 | FILTER3 | Filter Channel 3 | 6 | 14 | FILTER3 | Filter Channel 3 |
| 4 | 4 | FILTER4 | Filter Channel 4 | 5 | 13 | FILTER4 | Filter Channel 4 |
| | 5 | FILTER5 | Filter Channel 5 | | 12 | FILTER5 | Filter Channel 5 |
| | 6 | FILTER6 | Filter Channel 6 | | 11 | FILTER6 | Filter Channel 6 |
| | 7 | FILTER7 | Filter Channel 7 | | 10 | FILTER7 | Filter Channel 7 |
| | 8 | FILTER8 | Filter Channel 8 | | 9 | FILTER8 | Filter Channel 8 |
| GND Pad | | GND | Device Ground | | | | |

## SPECIFICATIONS

### Table 2. ABSOLUTE MAXIMUM RATINGS

| Parameter | Rating | Units |
|---|---|---|
| Storage Temperature Range | –65 to +150 | °C |
| DC Power per Resistor | 100 | mW |
| Package DC Power Rating | 300 | mW |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

### Table 3. STANDARD OPERATING CONDITIONS

| Parameter | Rating | Units |
|---|---|---|
| Operating Temperature Range | –40 to +85 | °C |

### Table 4. ELECTRICAL OPERATING CHARACTERISTICS (Note 1)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| R | Resistance | | 160 | 200 | 240 | Ω |
| C | Capacitance | At 2.5 V DC, 1 MHz, 30 mV AC | 12 | 15 | 18 | pF |
| $V_{DIODE}$ | Diode Standoff Voltage | $I_{DIODE}$ = 10 μA | | 6.0 | | V |
| $I_{LEAK}$ | Diode Leakage Current (Reverse Bias) | $V_{DIODE}$ = 3.3 V | | 0.1 | 1 | μA |
| $V_{SIG}$ | Signal Voltage<br>Positive Clamp<br>Negative Clamp | <br>$I_{LOAD}$ = 10 mA<br>$I_{LOAD}$ = –10 mA | <br>5.6<br>–1.5 | <br>6.8<br>–0.8 | <br>9.0<br>–0.4 | V |
| $V_{ESD}$ | In–system ESD Withstand Voltage<br>a) Human Body Model, MIL–STD–883, Method 3015<br>b) Contact Discharge per IEC 61000–4–2 Level 4 | (Note 2) | <br>30<br>15 | | | kV |
| $f_C$ | Cut–off Frequency<br>$Z_{SOURCE}$ = 50 Ω, $Z_{LOAD}$ = 50 Ω | R = 200 Ω, C = 15 pF | | 105 | | MHz |

1. $T_A$ = 25°C unless otherwise specified.
2. ESD applied to input and output pins with respect to GND, one at a time.

## PERFORMANCE INFORMATION

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

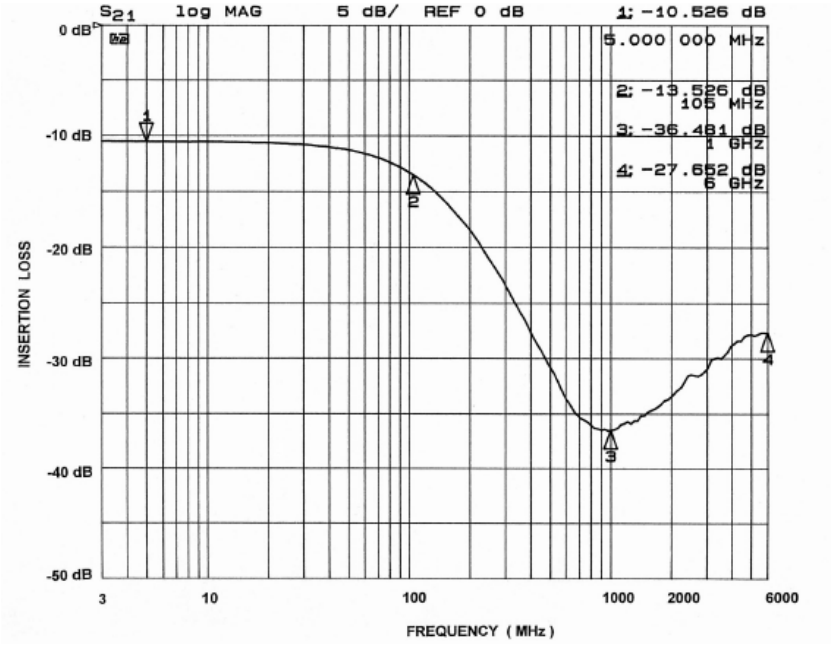



**Figure 1. Channel 1 EMI Filter Performance (CM1406−04 only)**

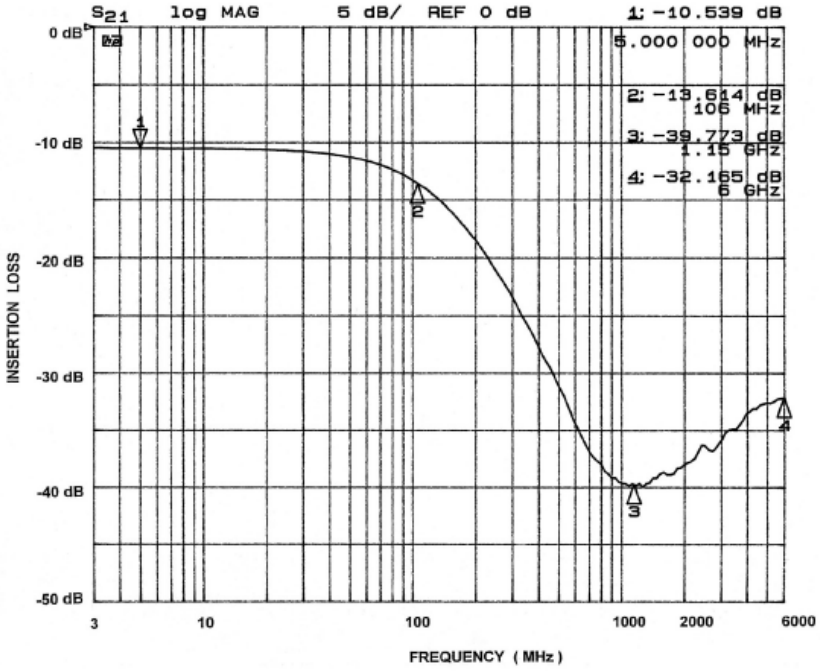



**Figure 2. Channel 2 EMI Filter Performance (CM1406−04 only)**

## PERFORMANCE INFORMATION (Cont'd)

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

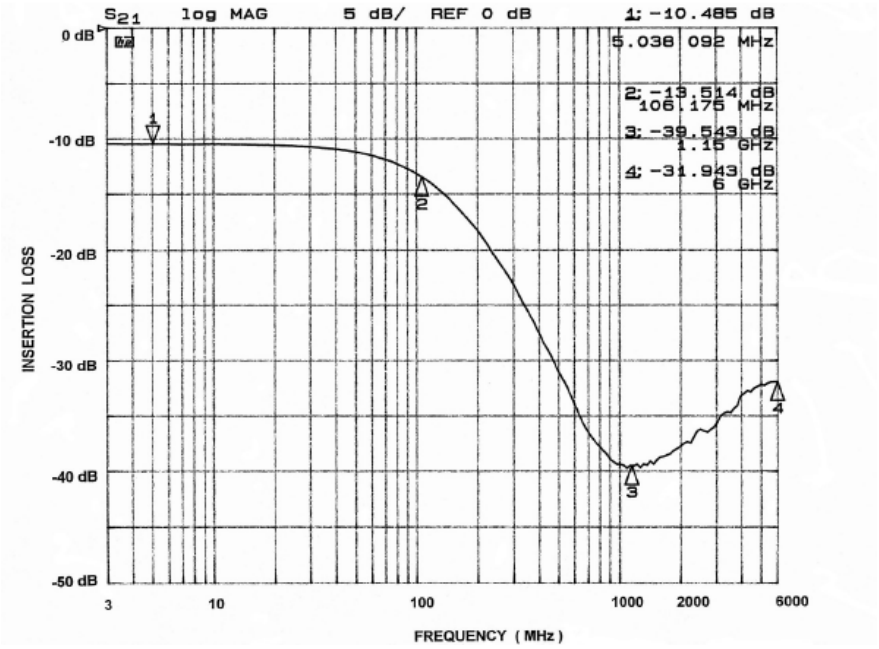



**Figure 3. Channel 3 EMI Filter Performance (CM1406−04 only)**

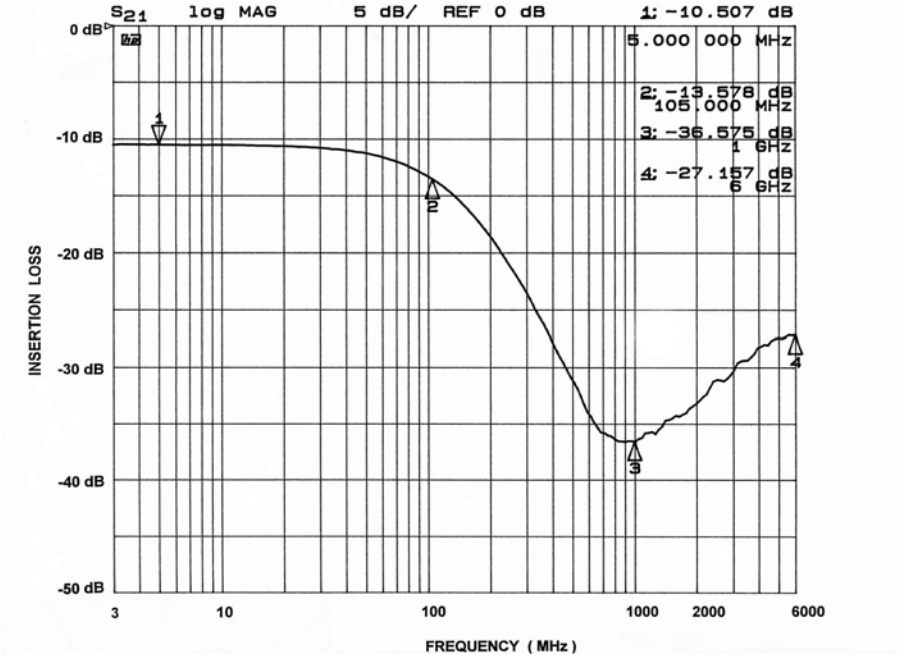



**Figure 4. Channel 4 EMI Filter Performance (CM1406−04 only)**

## PERFORMANCE INFORMATION (Cont'd)

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

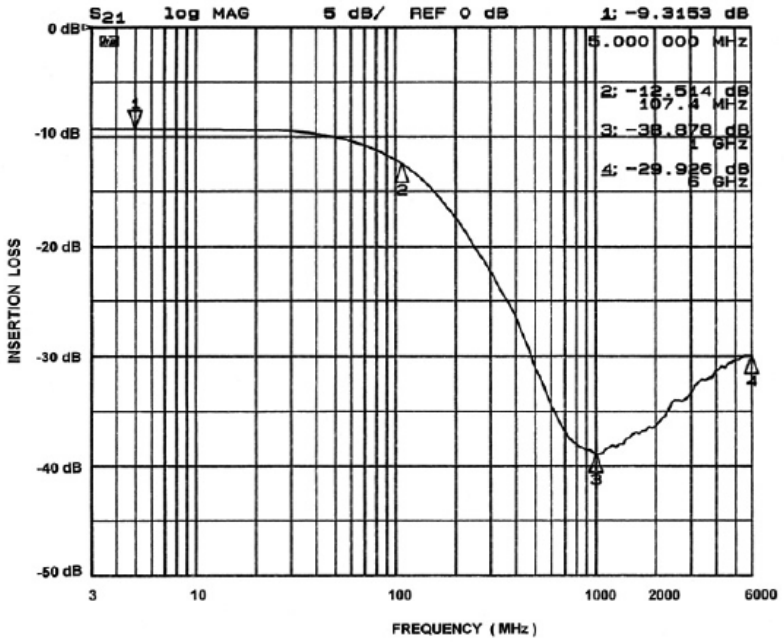



**Figure 5. Channel 1 EMI Filter Performance (CM1406−08 only)**

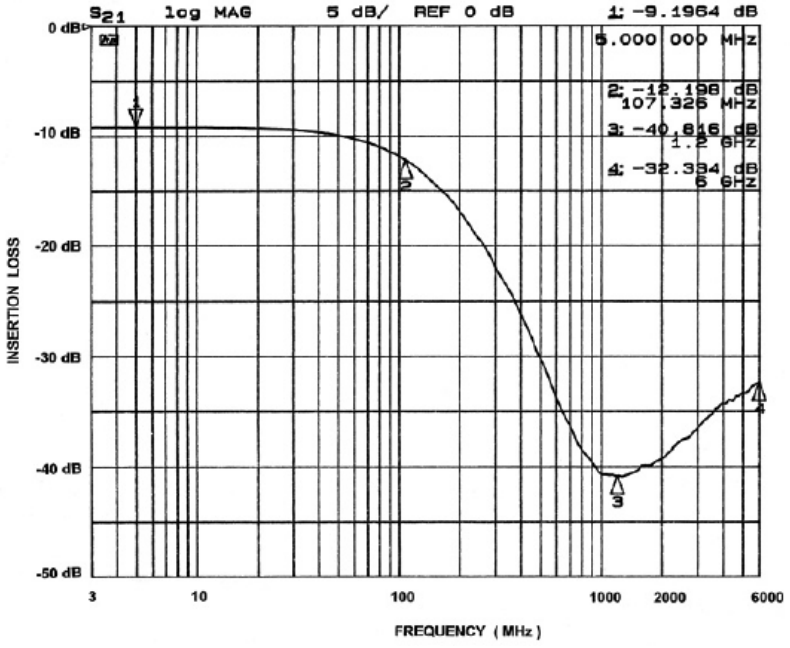



**Figure 6. Channel 2 EMI Filter Performance (CM1406−08 only)**

## PERFORMANCE INFORMATION (Cont'd)

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

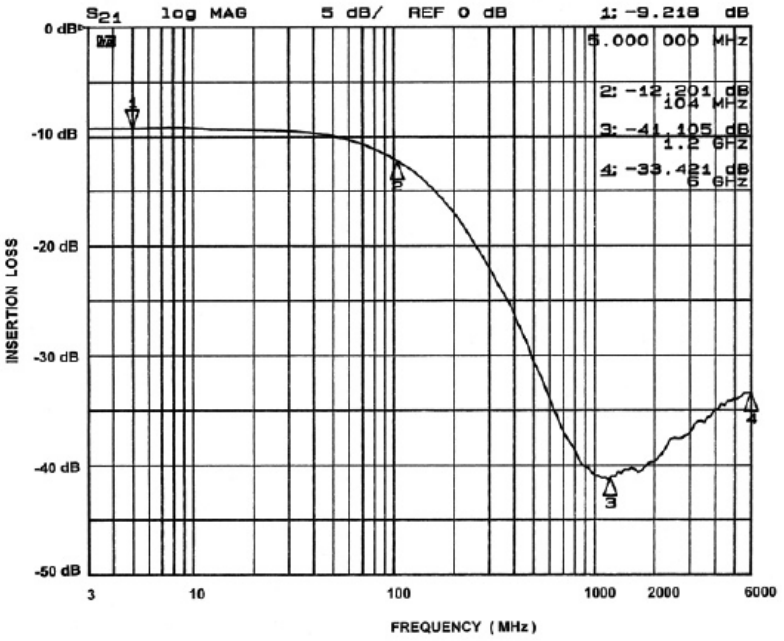



**Figure 7. Channel 3 EMI Filter Performance (CM1406−08 only)**

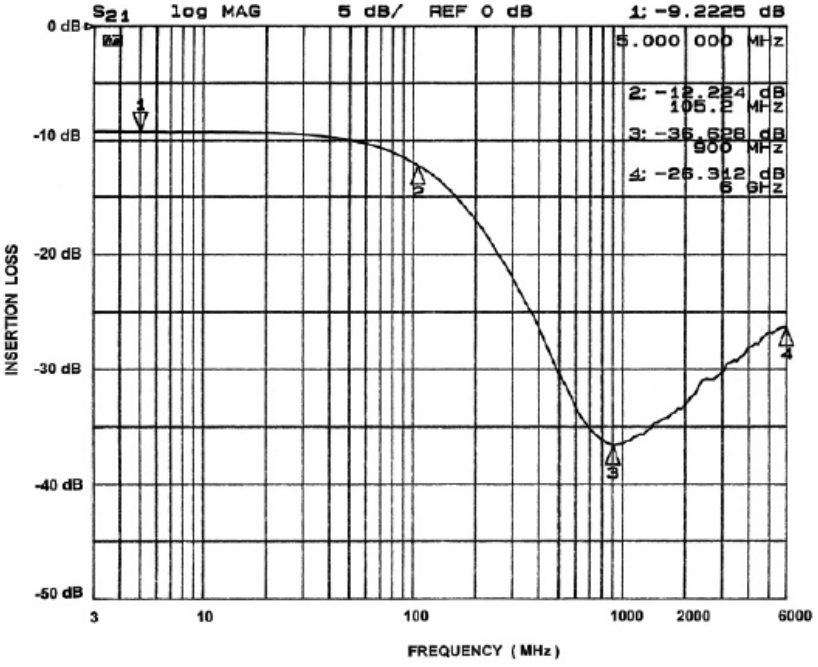



**Figure 8. Channel 4 EMI Filter Performance (CM1406−08 only)**

## PERFORMANCE INFORMATION (Cont'd)

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

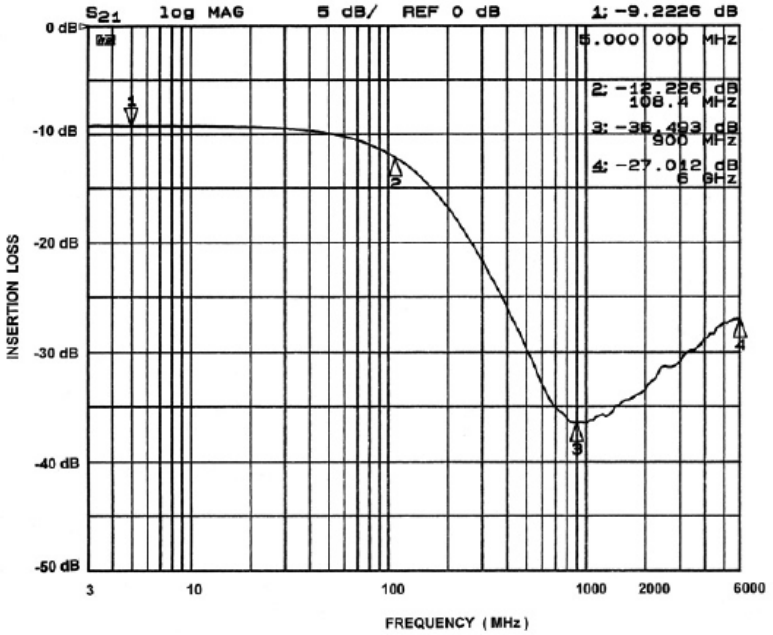



**Figure 9. Channel 5 EMI Filter Performance (CM1406−08 only)**

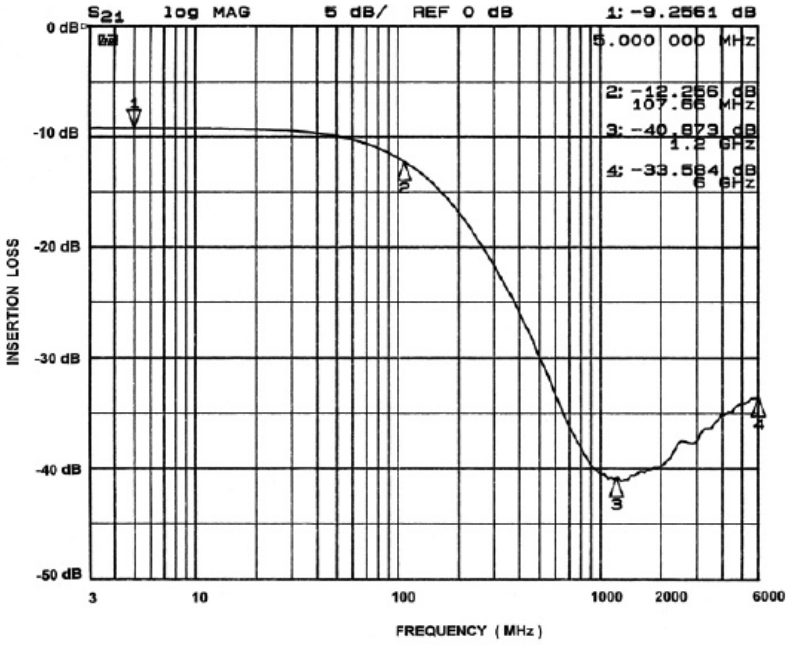



**Figure 10. Channel 6 EMI Filter Performance (CM1406−08 only)**

## PERFORMANCE INFORMATION (Cont'd)

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

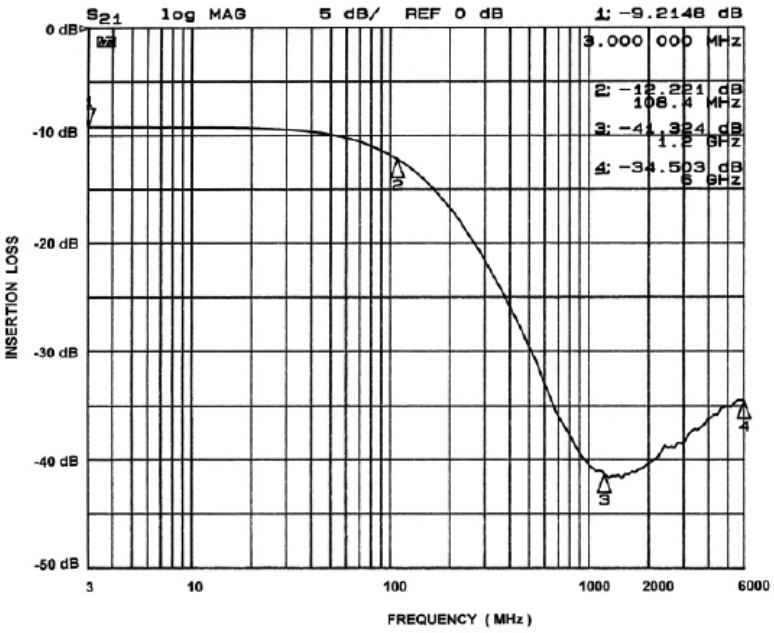



**Figure 11. Channel 7 EMI Filter Performance (CM1406−08 only)**

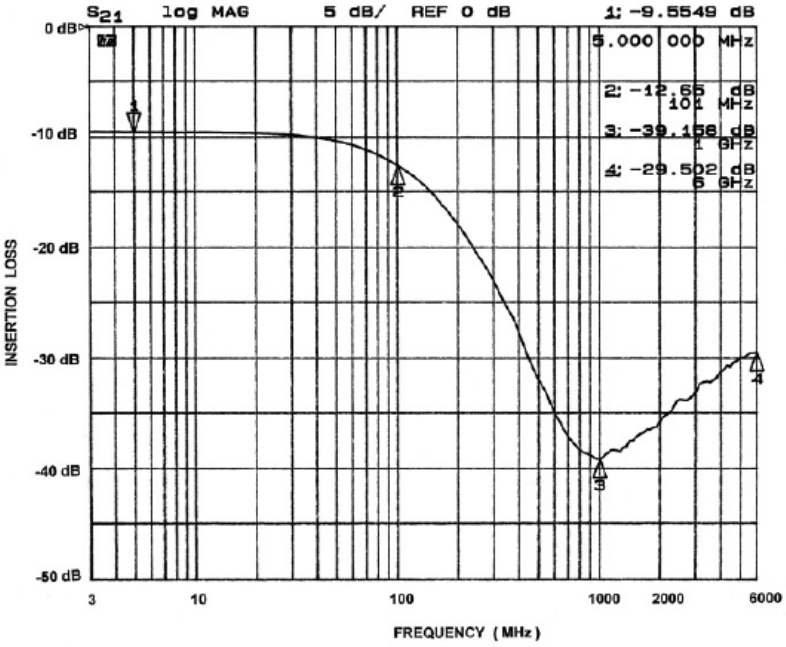



**Figure 12. Channel 8 EMI Filter Performance (CM1406−08 only)**

## PERFORMANCE INFORMATION (Cont'd)

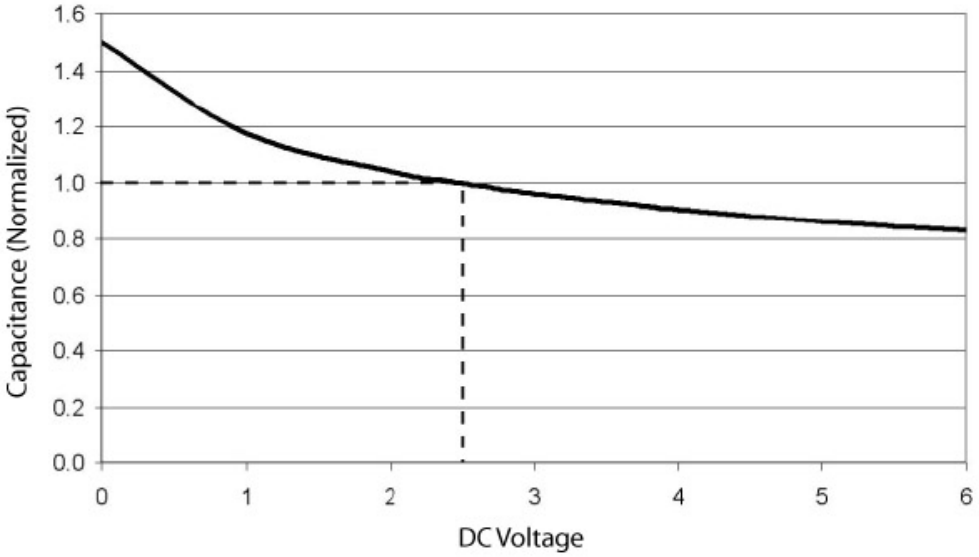
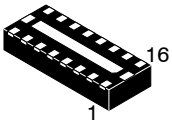



**Figure 13. Filter Capacitance vs. Input Voltage over Temperature (normalized to capacitance at 2.5 V DC and 25°C)**

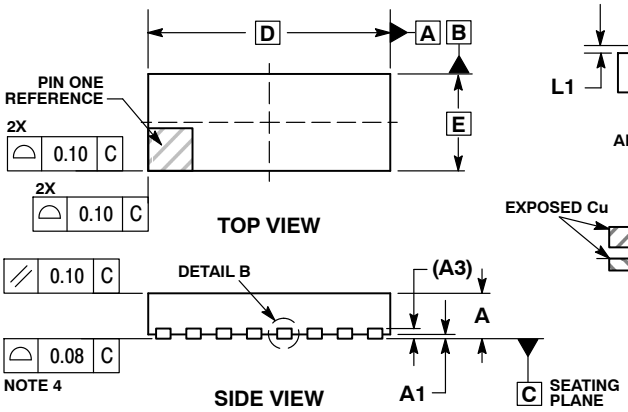
*Centurion* is a trademark of Semiconductor Components Industries, LLC (SCILLC).

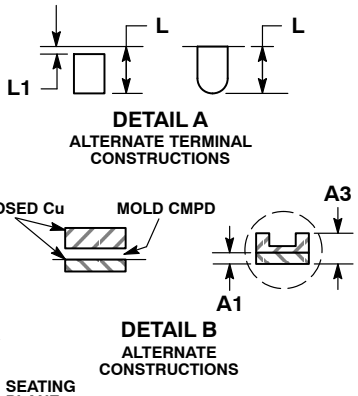
**WDFN16, 4x1.6, 0.5P**
CASE 511AU
ISSUE O

DATE 06 JUL 2010



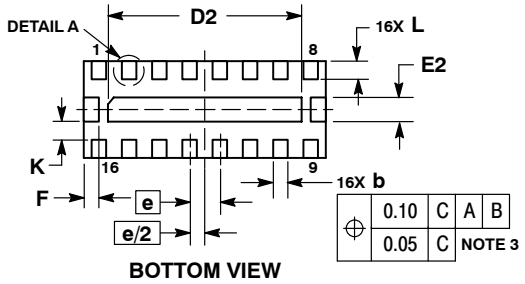

**SCALE 4:1**



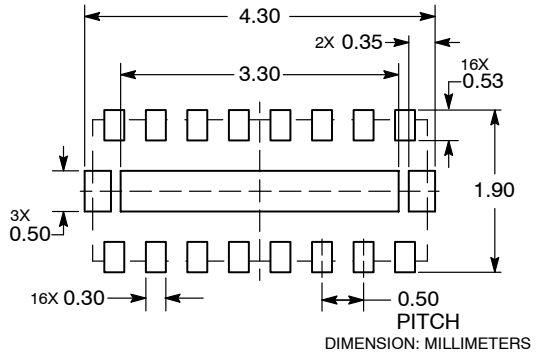




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | 0.70 | 0.80 |
| A1 | 0.00 | 0.05 |
| A3 | 0.20 REF | |
| b | 0.20 | 0.30 |
| D | 4.00 BSC | |
| D2 | 3.10 | 3.30 |
| E | 1.60 BSC | |
| E2 | 0.30 | 0.50 |
| e | 0.50 BSC | |
| F | 0.25 REF | |
| K | 0.30 REF | |
| L | 0.20 | 0.40 |
| L1 | --- | 0.15 |




**RECOMMENDED SOLDERING FOOTPRINT***




*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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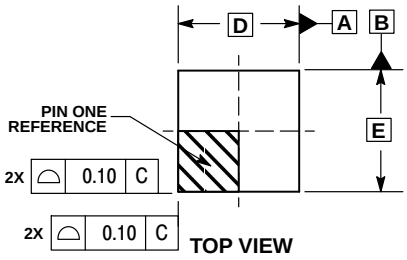
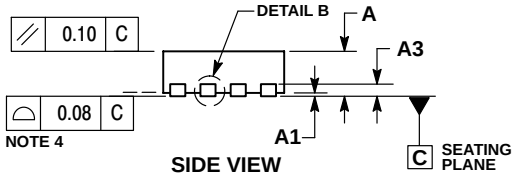
**WDFN8 2x2, 0.5P**
CASE 511BE
ISSUE A

DATE 27 MAY 2011

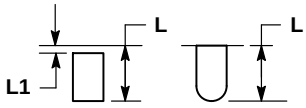
**SCALE 2:1**



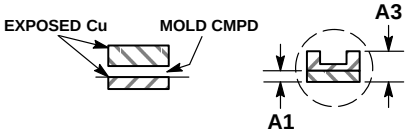

**TOP VIEW**




**SIDE VIEW**




**DETAIL A**
**ALTERNATE CONSTRUCTIONS**




**DETAIL B**
**ALTERNATE CONSTRUCTIONS**

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
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3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP.
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|---|---|---|
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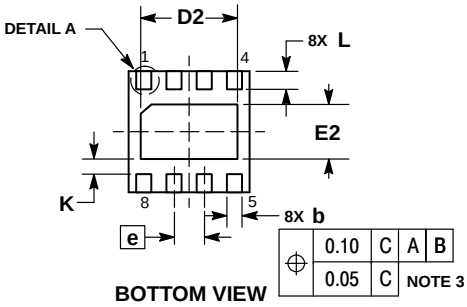
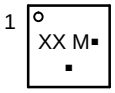
| A1 | 0.00 | 0.05 |
| A3 | 0.20 REF | |
| b | 0.20 | 0.30 |
| D | 2.00 BSC | |
| D2 | 1.50 | 1.70 |
| E | 2.00 BSC | |
| E2 | 0.80 | 1.00 |
| e | 0.50 BSC | |
| K | 0.25 REF | |
| L | 0.20 | 0.40 |
| L1 | ––– | 0.15 |




**BOTTOM VIEW**

**GENERIC MARKING DIAGRAM***

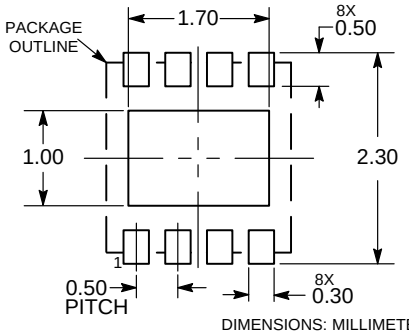



XX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

**RECOMMENDED SOLDERING FOOTPRINT***




DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

| | | |
|---|---|---|
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| **DESCRIPTION:** | **WDFN8, 2X2, 0.5P** | **PAGE 1 OF 1** |

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