

# CM1690

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

### Product Description

The CM1690 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  $\mu$ DFN 0.40 mm pitch packages. Each EMI filter channel of the CM1690 is implemented as a 3-pole L-C filter where the component values are 16 pF – 12 nH – 16 pF. The CM1690's roll-off frequency at –6 dB attenuation is 330 MHz and can be used in applications where the data rates are as high as 140 Mbps while providing greater than –35 dB attenuation over the 1.0 GHz to 3.0 GHz 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  $\pm 15$  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  $\pm 30$  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 CM1690 is ideal for EMI filtering and protecting data and control lines for the LCD display and camera interface in mobile handsets.

The CM1690 is available in space saving, ultra low profile 8-, 12-, and 16-lead 0.40 mm  $\mu$ DFN packages with lead-free finishing.

### 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
- $\pm 15$  kV ESD Protection on Each Channel (IEC 61000-4-2 Level 4, Contact Discharge)
- $\pm 30$  kV ESD Protection on Each Channel (HBM)
- Greater than –35 dB Attenuation (Typical) at 1 GHz
- 0.50 mm Thick  $\mu$ DFN Package with 0.40 mm Lead Pitch:
  - ♦ 4-ch. = 8-lead  $\mu$ DFN
  - ♦ 6-ch. = 12-lead  $\mu$ DFN
  - ♦ 8-ch. = 16-lead  $\mu$ DFN
- Tiny  $\mu$ DFN Package Size:
  - ♦ 8-lead: 1.70 mm x 1.35 mm
  - ♦ 12-lead: 2.50 mm x 1.35 mm
  - ♦ 16-lead: 3.30 mm x 1.35 mm
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- LCD and Camera Data Lines in Mobile Handsets
- Wireless Handsets
- LCD and Camera Modules



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UDFN8  
DE SUFFIX  
CASE 517BC

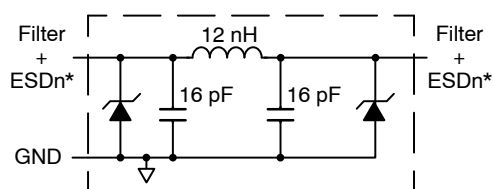


UDFN12  
DE SUFFIX  
CASE 517BD



UDFN16  
DE SUFFIX  
CASE 517BE

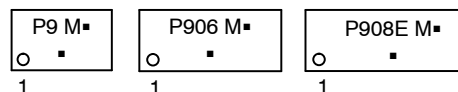
### ELECTRICAL SCHEMATIC



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

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

### MARKING DIAGRAM



P9 = CM1690-04DE  
P906 = CM1690-06DE  
P908E = CM1690-08DE  
M = Date Code  
■ = Pb-Free Package

(Note: Microdot may be in either location)

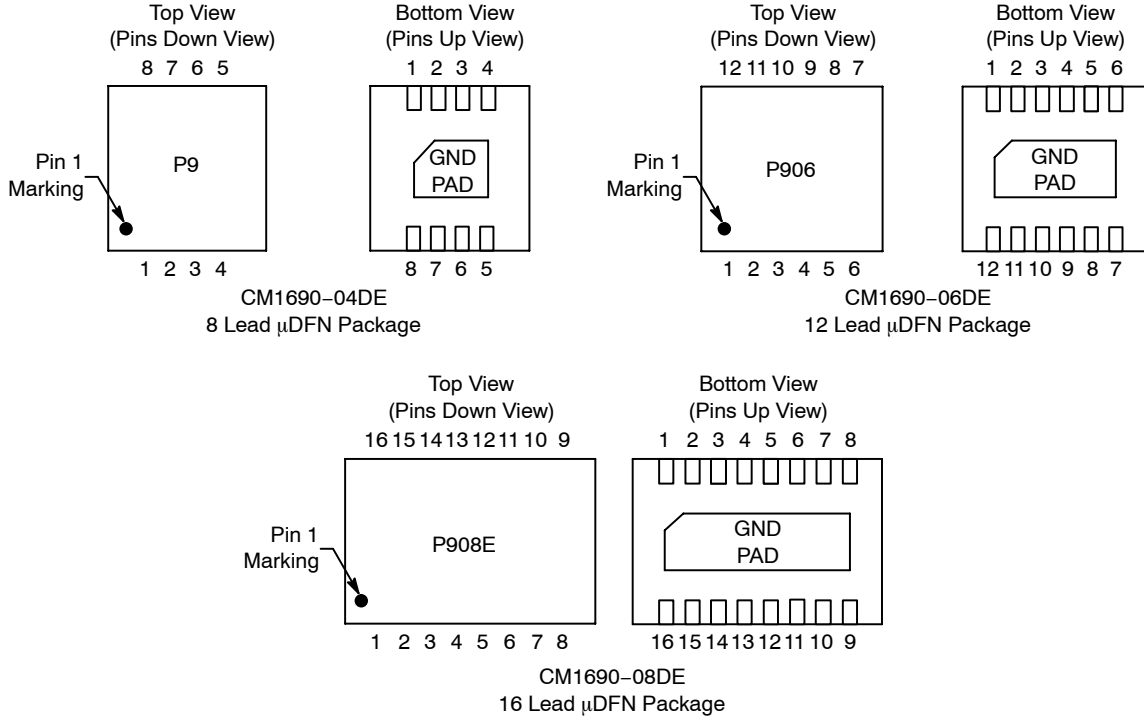
### ORDERING INFORMATION

| Device      | Package                | Shipping†        |
|-------------|------------------------|------------------|
| CM1690-04DE | $\mu$ DFN-8 (Pb-Free)  | 3000/Tape & Reel |
| CM1690-06DE | $\mu$ DFN-12 (Pb-Free) | 3000/Tape & Reel |
| CM1690-08DE | $\mu$ DFN-16 (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.

# CM1690

## PACKAGE / PINOUT DIAGRAMS



**Table 1. 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          | -             | -   | -   | -       |                        |

## SPECIFICATIONS

Table 2. ABSOLUTE MAXIMUM RATINGS

| Parameter                 | Rating      | Units |
|---------------------------|-------------|-------|
| Storage Temperature Range | -65 to +150 | °C    |
| Current per Inductor      | 30          | mA    |
| DC Package Power Rating   | 500         | 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      |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----------------------|-------------|-------------|------------|
| L                       | Channel Inductance                                                                                                                       |                                                                     |                      | 12          |             | nH         |
| C <sub>TOTAL</sub>      | Total Channel Capacitance                                                                                                                | At 2.5 V DC Reverse Bias,<br>1 MHz, 30 mV AC                        | 25                   | 33          | 40          | pF         |
| C                       | Capacitance C1                                                                                                                           | At 2.5 V DC Reverse Bias,<br>1 MHz, 30 mV AC                        |                      | 16.5        |             | pF         |
| V <sub>DIODE</sub>      | Stand-off Voltage                                                                                                                        | I <sub>DIODE</sub> = 10 $\mu$ A                                     |                      | 6.0         |             | V          |
| I <sub>LEAK</sub>       | Diode Leakage Current (Reverse Bias)                                                                                                     | V <sub>DIODE</sub> = 3.3 V                                          |                      | 0.1         | 0.3         | $\mu$ A    |
| V <sub>SIG</sub>        | Signal Clamp Voltage<br>Positive Clamp<br>Negative Clamp                                                                                 | I <sub>LOAD</sub> = 10 mA<br>I <sub>LOAD</sub> = -10 mA<br>(Note 3) | 5.6<br>-1.5          | 6.8<br>-0.8 | 9.0<br>-0.4 | V          |
| V <sub>ESD</sub>        | In-system ESD Withstand Voltage<br>a) Human Body Model, MIL-STD-883,<br>Method 3015<br>b) Contact Discharge per<br>IEC 61000-4-2 Level 4 | (Notes 2 and 4)                                                     | $\pm$ 30<br>$\pm$ 15 |             |             | kV         |
| R <sub>DYN</sub>        | Dynamic Resistance<br>Positive<br>Negative                                                                                               |                                                                     |                      | 2.3<br>0.9  |             | $\Omega$   |
| f <sub>C</sub>          | Roll-off Frequency at -6 dB Attenuation<br>Z <sub>SOURCE</sub> = 50 $\Omega$ , Z <sub>LOAD</sub> = 50 $\Omega$                           |                                                                     |                      | 330         |             | MHz        |
| R <sub>INSULATION</sub> | Insulation Resistance                                                                                                                    | V <sub>DIODE</sub> = 3.3 V (Note 4)                                 | 10                   |             |             | M $\Omega$ |
| R <sub>CHANNEL</sub>    | Channel Resistance                                                                                                                       |                                                                     |                      | 8           |             | $\Omega$   |

1. T<sub>A</sub> = 25°C unless otherwise specified.

2. ESD applied to input and output pins with respect to GND, one at a time.

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).

4. Unused pins are left open.

PERFORMANCE INFORMATION

Typical Diode Capacitance vs. Input Voltage

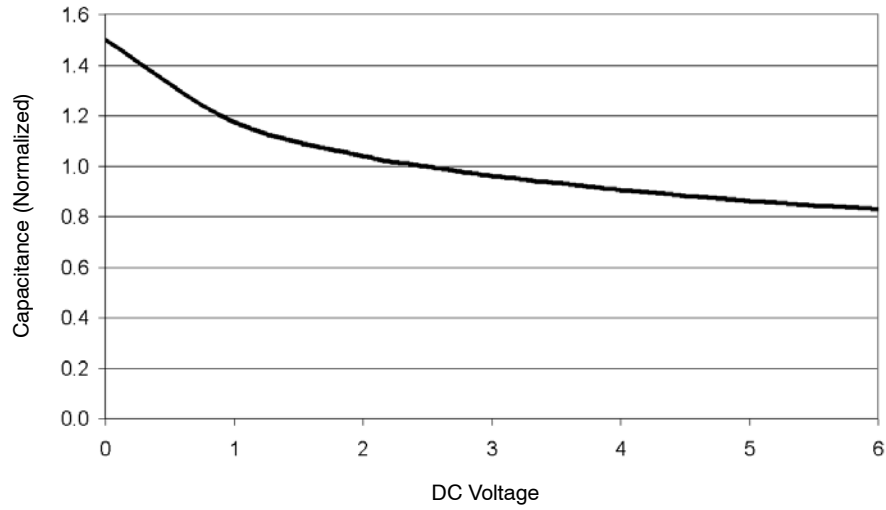


Figure 1. Filter Capacitance vs. Input Voltage  
(normalized to capacitance at 2.5 V DC and 25°C)

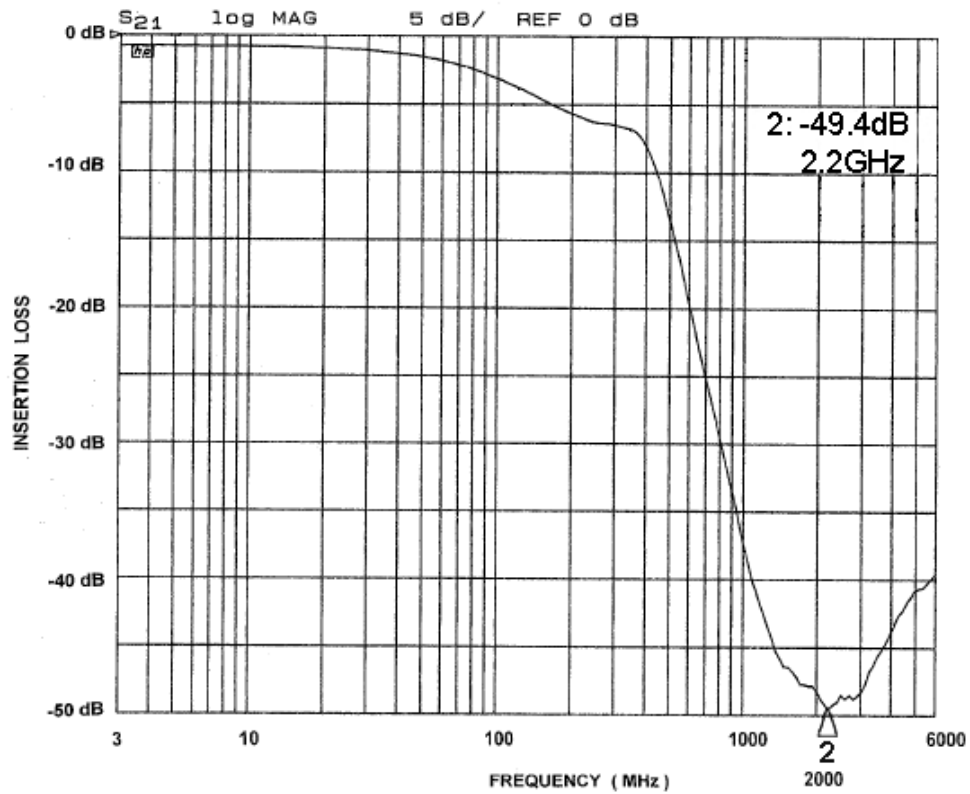


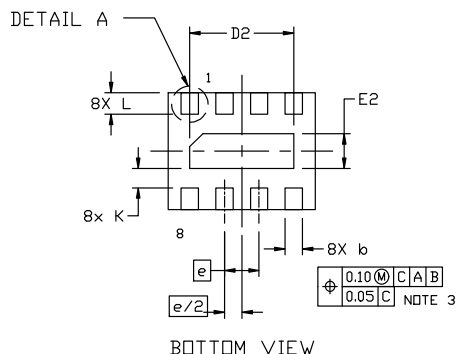
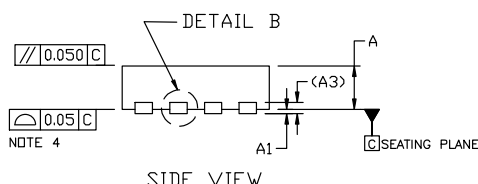
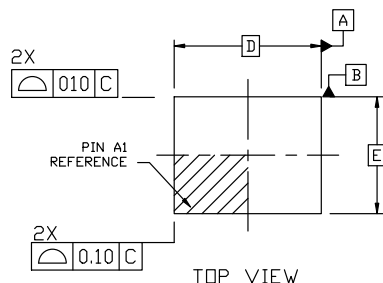
Figure 2. Typical Performance Curve



SCALE 4:1

**UDFN8, 1.7x1.35, 0.4P**  
**CASE 517BC**  
**ISSUE A**

DATE 11 AUG 2022


**GENERIC MARKING DIAGRAMS\***

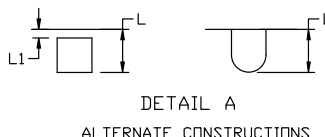
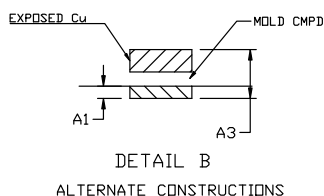

XXX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

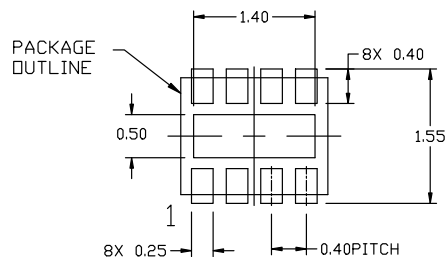
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2004.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.25MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.



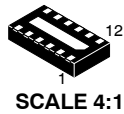
| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN.        | MAX. |
| A   | 0.45        | 0.55 |
| A1  | 0.00        | 0.05 |
| A3  | 0.13 REF    |      |
| b   | 0.15        | 0.25 |
| D   | 1.70 BSC    |      |
| D2  | 1.10        | 1.30 |
| E   | 1.35 BSC    |      |
| E2  | 0.30        | 0.50 |
| e   | 0.40 BSC    |      |
| K   | 0.15        | ---  |
| L   | 0.20        | 0.30 |
| L1  | ---         | 0.05 |


**RECOMMENDED MOUNTING FOOTPRINT\***

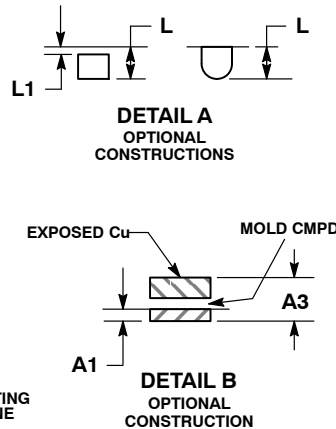
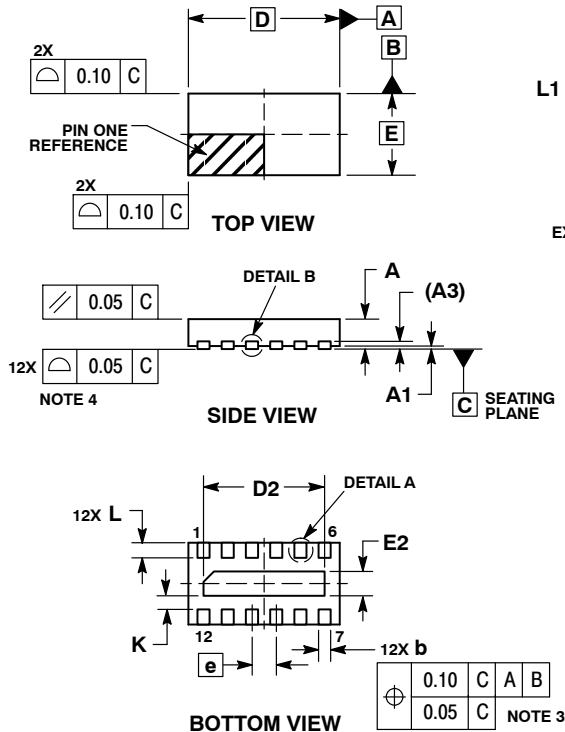
\* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

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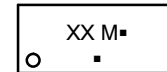

**UDFN12, 2.5x1.35, 0.4P**  
**CASE 517BD**  
**ISSUE O**

DATE 18 NOV 2009



- 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 0.25 mm FROM THE TERMINAL TIP.
  4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| MILLIMETERS |      |      |
|-------------|------|------|
| DIM         | MIN  | MAX  |
| A           | 0.45 | 0.55 |
| A1          | 0.00 | 0.05 |
| A3          | 0.13 | REF  |
| b           | 0.15 | 0.25 |
| D           | 2.50 | BSC  |
| D2          | 1.90 | 2.10 |
| E           | 1.35 | BSC  |
| E2          | 0.30 | 0.50 |
| e           | 0.40 | BSC  |
| K           | 0.15 | ---  |
| L           | 0.20 | 0.30 |
| L1          | ---  | 0.05 |

**GENERIC MARKING DIAGRAM\***


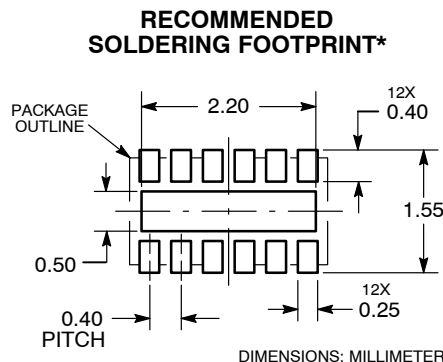
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- XX = Specific Device Code  
M = Month Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking.

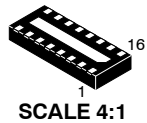
Pb-Free indicator, "G" or microdot "▪", may or may not be present.



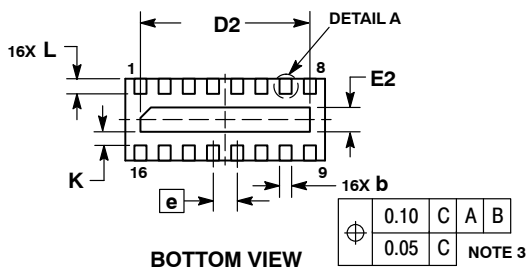
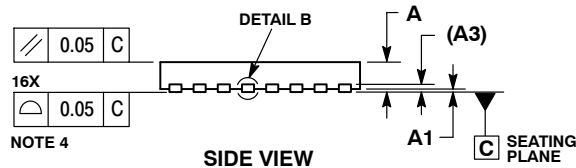
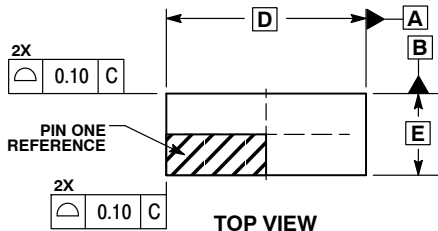
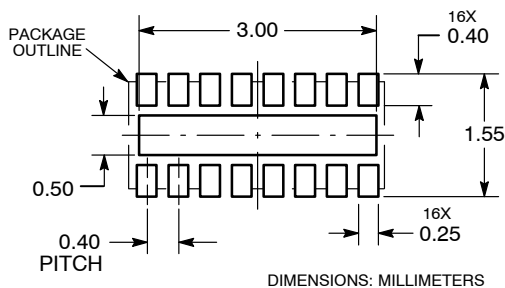
\*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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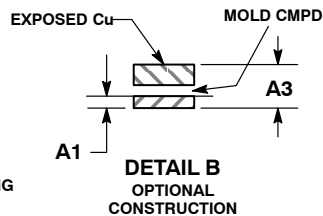
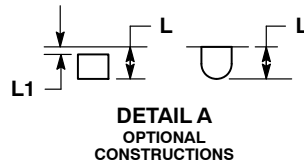
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**UDFN16, 3.3x1.35, 0.4P**  
CASE 517BE  
ISSUE O

DATE 18 NOV 2009

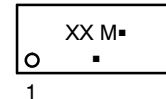

**RECOMMENDED  
SOLDERING FOOTPRINT\***


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| MILLIMETERS |      |      |
|-------------|------|------|
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| A1          | 0.00 | 0.05 |
| A3          | 0.13 | REF  |
| b           | 0.15 | 0.25 |
| D           | 3.30 | BSC  |
| D2          | 2.70 | 2.90 |
| E           | 1.35 | BSC  |
| E2          | 0.30 | 0.50 |
| e           | 0.40 | BSC  |
| K           | 0.15 | ---  |
| L           | 0.20 | 0.30 |
| L1          | ---  | 0.05 |

**GENERIC  
MARKING DIAGRAM\***


- XX = Specific Device Code  
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(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking.

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| <b>DESCRIPTION:</b>     | <b>UDFN16, 3.3X1.35, 0.4P</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                                  |

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