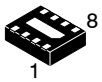
L-C LCD and Camera EMI Filter Array with ESD Protection

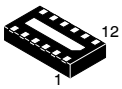
CM1693-04DE, CM1693-06DE, CM1693-08DE

ON Semiconductor®

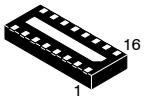
www.onsemi.com



uDFN8
DE SUFFIX
CASE 517BC

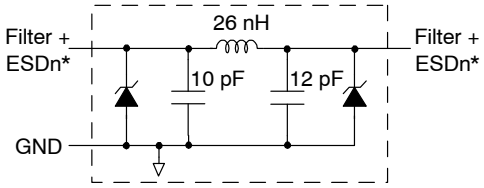


uDFN12
DE SUFFIX
CASE 517BD



uDFN16
DE SUFFIX
CASE 517BE

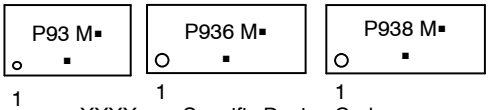
ELECTRICAL SCHEMATIC



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

* See Package/Pinout Diagram for expanded pin information

MARKING DIAGRAM



XXXX = Specific Device Code
M = Month Code
▪ = Pb−Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
CM1693−04DE	uDFN−8 (Pb−Free)	3000/Tape & Reel
CM1693−06DE	uDFN−12 (Pb−Free)	3000/Tape & Reel
CM1693−08DE	uDFN−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.

Product Description

The CM1693 is a family of pi−style EMI filter arrays with ESD protection, which integrates four, six or eight filters (C−L−C) into a small−form factor, uDFN 0.40 mm pitch package. Each EMI filter channel is implemented as a 3−pole L−C filter, where the component values are 10 pF−26 nH−12 pF. The CM1693's roll−off frequency at −6 dB attenuation is 300 MHz and can be used in applications where the data rates are as high as 140 Mbps. The CM1693 also provides greater than −30 dB attenuation over the 800 MHz to 6 GHz frequency range. The device includes ESD diodes on every pin that provide a very high level of protection for sensitive electronic components against possible electrostatic discharge (ESD). The ESD protection diodes connected to the filter ports are designed and characterized to safely dissipate ESD strikes of ±18 kV, which is beyond the maximum requirement of the IEC61000−4−2 international standard.

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 CM1693 is ideal for EMI filtering and protecting data and control lines for the LCD display and camera interface in mobile handsets.

The CM1693 is housed in space saving, low profile, 0.40 mm pitch uDFN packages in a RoHS compliant, Pb−Free format.

Features

- 4, 6 or 8 Channels of EMI Filtering with Integrated ESD Protection
- Pi−Style EMI Filters in a Capacitor−Inductor−Capacitor (C−L−C) Network
- +18 kV ESD Protection on Each Channel (IEC 61000−4−2 Level 4, Contact Discharge)
- Greater than −35 dB Attenuation (Typical) at 1GHz
- uDFN Lead−Free Package with 0.40 mm Lead Pitch:
  - 4−Ch. = 8−Lead uDFN
  - 6−Ch. = 12−Lead uDFN
  - 8−Ch. = 16−Lead uDFN
- uDFN 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
- Increased Robustness Against Vertical Impacts During Manufacturing Process
- These Devices are Pb−Free and are RoHS Compliant

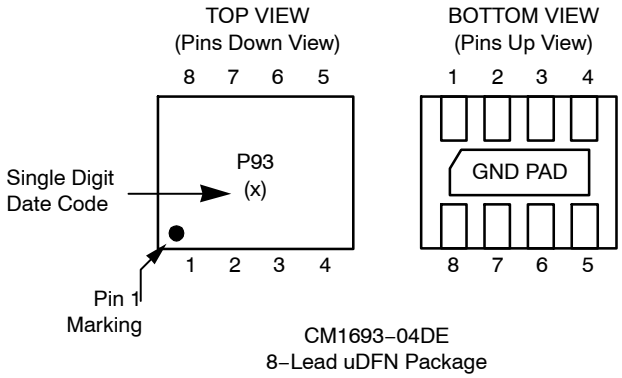
Applications

- LCD and Camera Data Lines in Mobile Handsets
- I/O Port Protection for Mobile Handsets, Notebook Computers, PDAs etc.
- Handheld PCs/PDAs
- LCD and Camera Modules
- EMI Filtering for Data Ports in Cell Phones, PDAs or Notebook Computers.
- Wireless Handsets

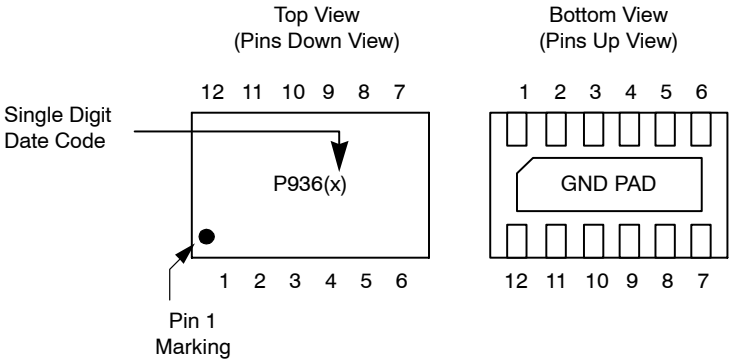
Table 1. PIN DESCRIPTIONS

Device Pin(s)			Name	Description
−04	−06	−08		
1; 8	1; 12	1; 16	FILTER1	Filter + ESD Channel 1
2; 7	2; 11	2; 15	FILTER2	Filter + ESD Channel 2
3; 6	3; 10	3; 14	FILTER3	Filter + ESD Channel 3
4; 5	4; 9	4; 13	FILTER4	Filter + ESD Channel 4
	5; 8	5; 12	FILTER5	Filter + ESD Channel 5
	6; 7	6; 11	FILTER6	Filter + ESD Channel 6
		7; 10	FILTER7	Filter + ESD Channel 7
		8; 9	FILTER8	Filter + ESD Channel 8
GND PAD			GND	Device Ground

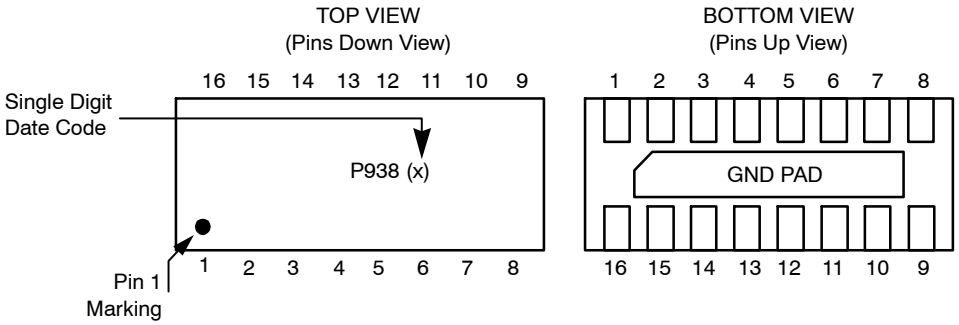
PACKAGE / PINOUT DIAGRAMS



CM1693−04DE
8−Lead uDFN Package



CM1693−06DE
12−Lead uDFN Package



CM1693−08DE
16−Lead uDFN Package

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 those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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			26		nH
C_{TOTAL}	Total Channel Capacitance (Note 4)	At 2.5 VDC Reverse Bias, 1 MHz, 30 mVAC	17.6	22	26.4	pF
V_{DIODE}	Standoff Voltage	I_{DIODE} = 10 μA	5.5			V
I_{LEAK}	Diode Leakage Current (reverse bias)	V_{DIODE} = +3.3 V		0.1	1.0	μA
V_{SIG}	Signal Clamp Voltage Positive Clamp Negative Clamp	 I_{LOAD} = 10 mA I_{LOAD} = −10 mA	 5.6 −1.5	 6.8 −0.8	 9.0 −0.4	V
V_{ESD}	In−system ESD Withstand Voltage Contact Discharge per IEC 61000−4−2 Level 4	(Notes 2, 3 and 4)	 ±18			kV
R_{DYN}	Dynamic Resistance Positive Negative			 2.3 0.9		Ω
f_R	Roll−off Frequency at −6 dB Attenuation Z_{SOURCE} = 50 Ω, Z_{LOAD} = 50 Ω			 300		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.
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.
4. These parameters are guaranteed by design and characterization.

PERFORMANCE INFORMATION

Typical Filter Performance (T_A = 25°C, DC Bias = 0 V, 50 Ohm Environment)

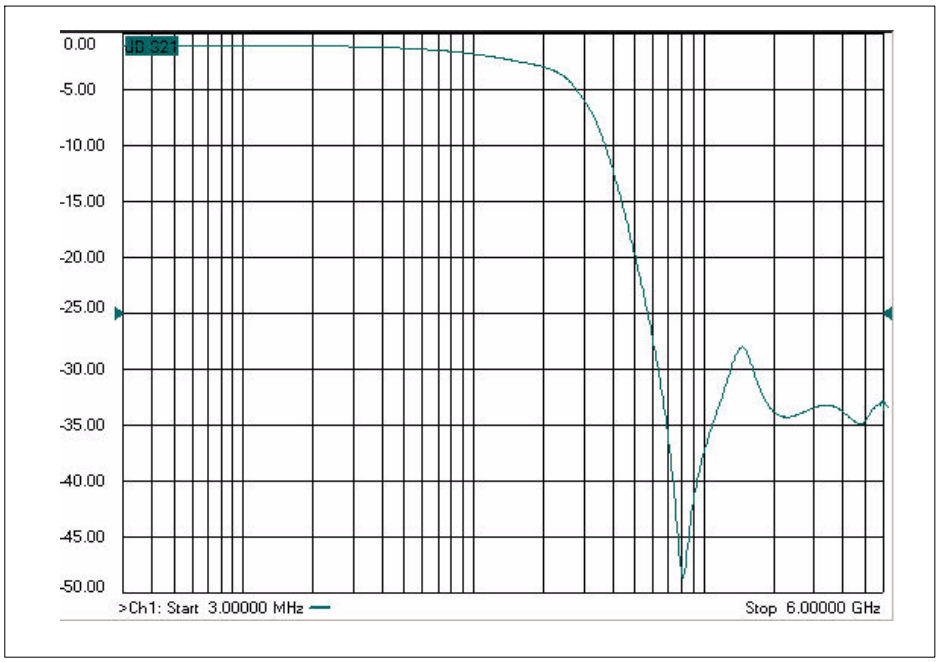


Figure 1. Typical Filter Insertion Loss (CM1693)

Typical Diode Capacitance vs. Input Voltage

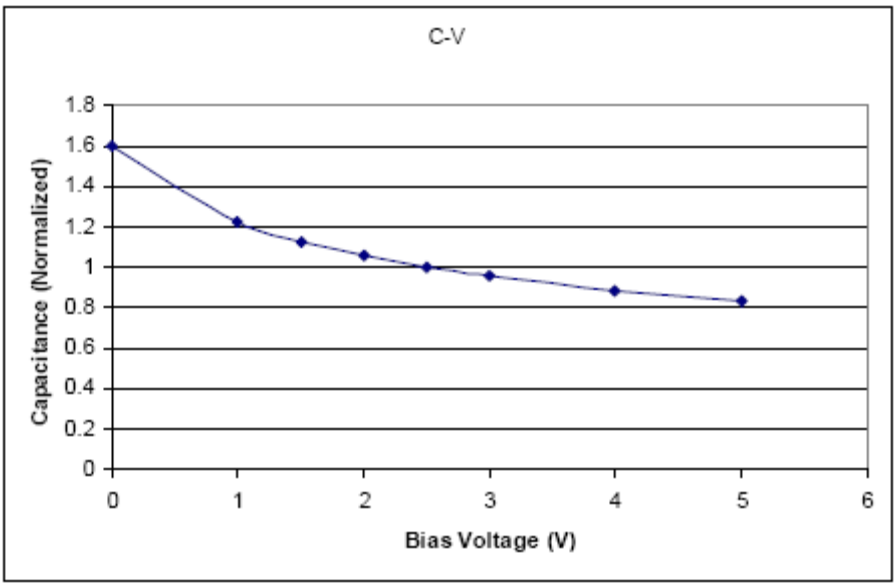


Figure 2. Filter Capacitance vs. Input Voltage (Normalized to Capacitance at 0 VDC and 25°C)

MECHANICAL DETAILS

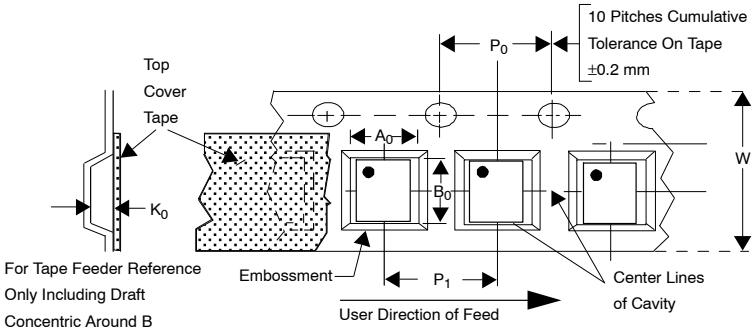
uDFN−08, uDFN−12 and uDFN−16 Mechanical Specifications, 0.4mm

The 8−lead, 12−lead and 16−lead, 0.4 mm pitch uDFN package dimensions are presented below.

Table 5. TAPE AND REEL SPECIFICATIONS

Part Number	Package Size (mm)	Pocket Size (mm) B_0 x A_0 x K_0	Tape Width† W	Reel Diameter	Qty per Reel	P_0	P_1
CM1693−04DE	1.70 x 1.35 x 0.50	1.95 x 1.60 x 0.60	8 mm	178 mm (7″)	3000	4 mm	4 mm
CM1693−06DE	2.50 x 1.35 x 0.50	2.75 x 1.60 x 0.60	8 mm	178 mm (7″)	3000	4 mm	4 mm
CM1693−08DE	3.30 x 1.35 x 0.50	3.50 x 1.55 x 0.70	12 mm	178 mm (7″)	3000	4 mm	4 mm

†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.



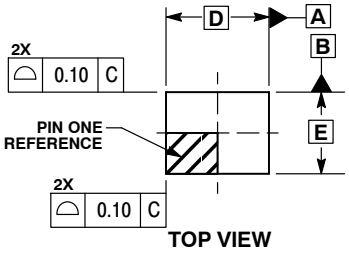
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

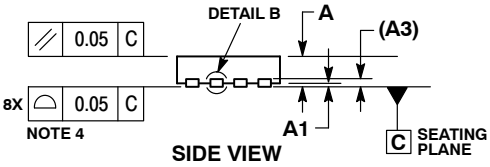
UDFN8, 1.7x1.35, 0.4P
CASE 517BC−01
ISSUE O

DATE 17 NOV 2009

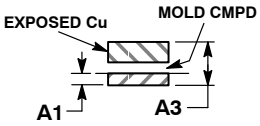
SCALE 4:1



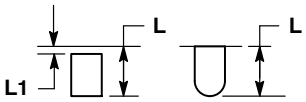
TOP VIEW



SIDE VIEW



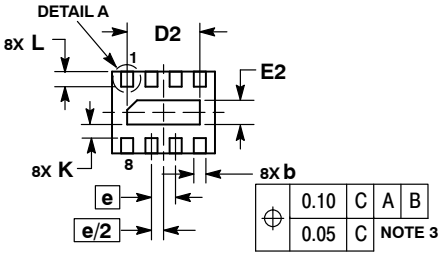
DETAIL B
ALTERNATE CONSTRUCTIONS



DETAIL A
ALTERNATE TERMINAL CONSTRUCTIONS

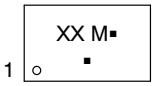
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.25 mm FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS	
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13 REF	
b	0.15	0.25
D	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



BOTTOM VIEW

GENERIC MARKING DIAGRAM*

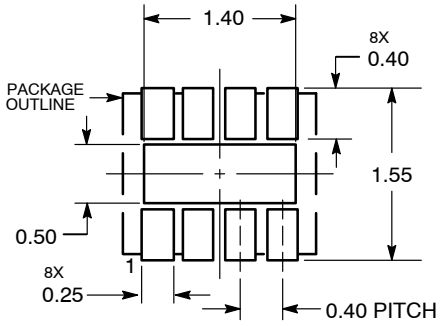


XX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(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”, may or not be present.

RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

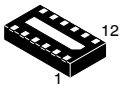
DOCUMENT NUMBER:	**98AON47060E**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	**8 PIN UDFN, 1.7X1.35, 0.4P**	**PAGE 1 OF 1**

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

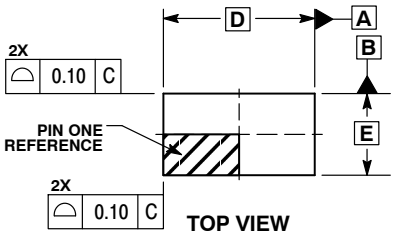
ON Semiconductor®

UDFN12, 2.5x1.35, 0.4P
CASE 517BD−01
ISSUE O

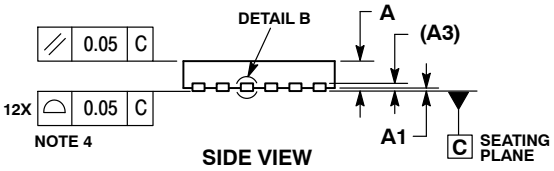
DATE 18 NOV 2009



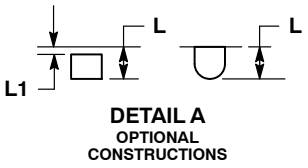
SCALE 4:1



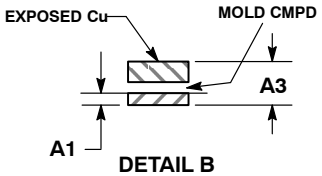
TOP VIEW



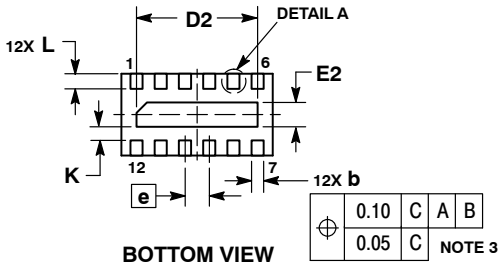
SIDE VIEW



DETAIL A
OPTIONAL CONSTRUCTIONS



DETAIL B
OPTIONAL CONSTRUCTION



BOTTOM VIEW

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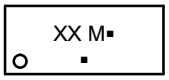
b	0.15	0.25
D	2.50 BSC	
D2	1.90	2.10
E	1.35 BSC	
E2	0.30	0.50
e	0.40 BSC	
K	0.15	−−−
L	0.20	0.30
L1	−−−	0.05

GENERIC MARKING DIAGRAM*



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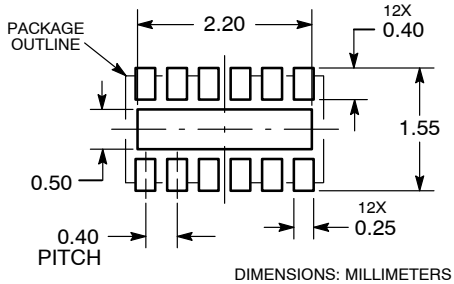
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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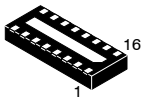
DOCUMENT NUMBER:	**98AON47061E**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	**UDFN12, 2.5X1.35, 0.4P**	**PAGE 1 OF 1**

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

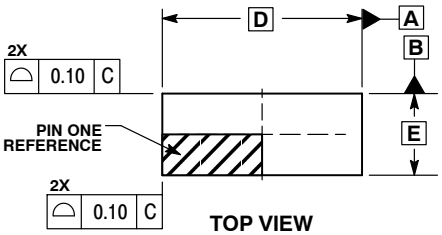
ON Semiconductor®

UDFN16, 3.3x1.35, 0.4P
CASE 517BE−01
ISSUE O

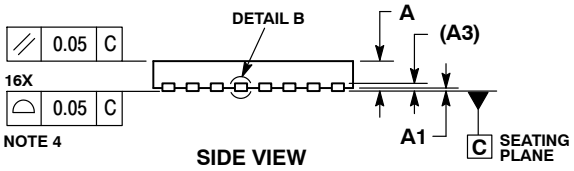
DATE 18 NOV 2009



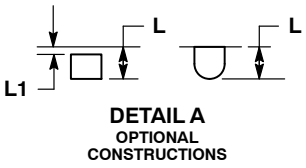
SCALE 4:1



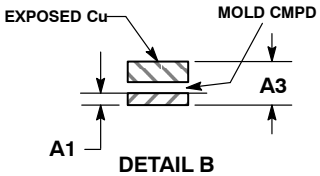
TOP VIEW



SIDE VIEW



DETAIL A
OPTIONAL CONSTRUCTIONS



DETAIL B
OPTIONAL CONSTRUCTION

NOTES:
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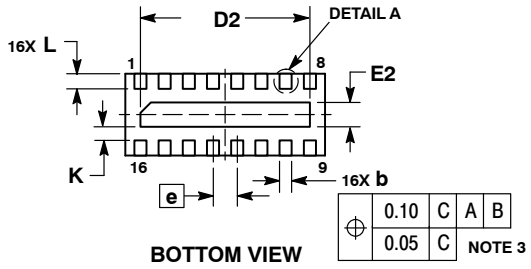
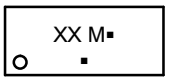
A3	0.13 REF	
b	0.15	0.25
D	3.30 BSC	
D2	2.70	2.90
E	1.35 BSC	
E2	0.30	0.50
e	0.40 BSC	
K	0.15	−−−
L	0.20	0.30
L1	−−−	0.05



BOTTOM VIEW

GENERIC MARKING DIAGRAM*



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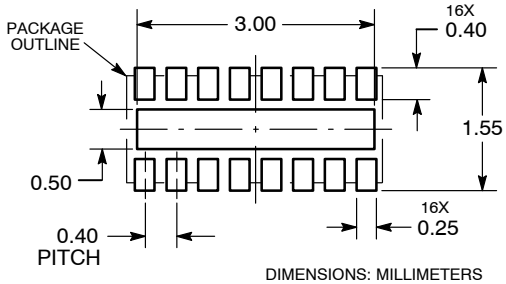
▪ = Pb−Free Package

(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 ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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