MC10EL89

5V ECL Coaxial Cable Driver

The MC10EL89 is a differential fanout gate specifically designed to drive coaxial cables. The device is especially useful in Digital Video Broadcasting applications; for this application, since the system is polarity free, each output can be used as an independent driver. The driver boasts a gain of approximately 40 and produces output swings twice as large as a standard ECL output. When driving a coaxial cable, proper termination is required at both ends of the line to minimize signal loss. The 1.6 V output swings allow for termination at both ends of the cable, while maintaining the required 800 mV swing at the receiving end of the cable. Because of the larger output swings, the device cannot be terminated into the standard −2.0 V. All of the DC parameters are tested with a 50 Ω to −3.0 V load. The driver accepts a standard differential ECL input and can run off of the Digital Video Broadcast standard −5.0 V supply.

Features

- 375 ps Propagation Delay
- 1.6 V Output Swings
- PECL Mode Operating Range: V_{CC} = 4.2 V to 5.7 V with V_{EE} = 0 V
- NECL Mode Operating Range: V_{CC} = 0 V with V_{EE} = −4.2 V to −5.7 V
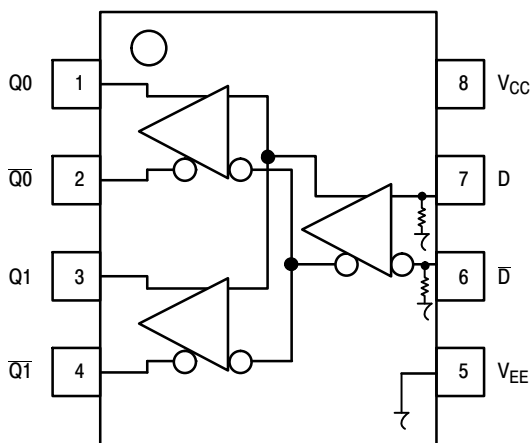- Internal Input Pulldown Resistors
- Pb−Free Packages are Available

Figure 1. Logic Diagram and Pinout Assignment

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MARKING DIAGRAMS*

SOIC−8
D SUFFIX
CASE 751

HEL89
ALYW

TSSOP−8
DT SUFFIX
CASE 948R

HL89
ALYW▪

DFN8
MN SUFFIX
CASE 506AA

5A M̄

A	= Assembly Location
L	= Wafer Lot
Y	= Year
W	= Work Week
$\overline{M}$	= Date Code
▪	= Pb−Free Package

(Note: Microdot may be in either location)

*For additional marking information, refer to Application Note AND8002/D.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

Table 1. PIN DESCRIPTION

PIN	Function
D, $\overline{D}$	ECL Data Inputs
Q0, $\overline{Q0}$; Q1, $\overline{Q1}$	ECL Data Outputs (1.6 V_{pp})
V_{CC}	Positive Supply
V_{EE}	Negative Supply
EP	(DFN8 only) Thermal exposed pad must be connected to a sufficient thermal conduit. Electrically connect to the most negative supply (GND) or leave unconnected, floating open.

Table 2. ATTRIBUTES

Characteristics		Value
Internal Input Pulldown Resistor		50 KΩ
Internal Input Pullup Resistor		N/A
ESD Protection	Human Body Model Machine Model	> 2 kV > 100 V
Moisture Sensitivity, Indefinite Time Out of Drypack (Note 1)		Level 1
Flammability Rating	Oxygen Index: 28 to 34	UL 94 V–0 @ 0.125 in
Transistor Count		31
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test		

1. For additional information, see Application Note AND8003/D.

Table 3. MAXIMUM RATINGS

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V_{CC}	PECL Mode Power Supply	V_{EE} = 0 V		8	V
V_{EE}	NECL Mode Power Supply	V_{CC} = 0 V		–8	V
V_I	PECL Mode Input Voltage NECL Mode Input Voltage	V_{EE} = 0 V V_{CC} = 0 V	$V_I \leq V_{CC}$ $V_I \geq V_{EE}$	6 –6	V V
I_{out}	Output Current	Continuous Surge		50 100	mA mA
T_A	Operating Temperature Range			–40 to +85	°C
T_{stg}	Storage Temperature Range			–65 to +150	°C
θ_{JA}	Thermal Resistance (Junction–to–Ambient)	0 lfpm 500 lfpm	SO–8 SO–8	190 130	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction–to–Case)	Standard Board	SO–8	41 to 44	°C/W
θ_{JA}	Thermal Resistance (Junction–to–Ambient)	0 lfpm 500 lfpm	TSSOP–8 TSSOP–8	185 140	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction–to–Case)	Standard Board	TSSOP–8	41 to 44 ± 5%	°C/W
θ_{JA}	Thermal Resistance (Junction–to–Ambient)	0 lfpm 500 lfpm	DFN8 DFN8	129 84	°C/W °C/W
T_{sol}	Wave Solder Pb Pb–Free	<2 to 3 sec @ 248°C <2 to 3 sec @ 260°C		265 265	°C
θ_{JC}	Thermal Resistance (Junction–to–Case)	(Note 2)	DFN8	35 to 40	°C/W

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.

2. JEDEC standard multilayer board – 2S2P (2 signal, 2 power)

Table 4. 10EL SERIES PECL DC CHARACTERISTICS V_{CC} = 5.0 V; V_{EE} = 0.0 V (Note 3)

Symbol	Characteristic	−40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		23	28		23	28		23	28	mA
V_{OH}	Output HIGH Voltage (Note 4)	3.77	3.90	4.02	3.87	3.98	4.10	3.94	4.04	4.19	V
V_{OL}	Output LOW Voltage (Note 4)	2.10	2.28	2.42	2.00	2.30	2.44	1.95	2.33	2.49	V
V_{IH}	Input HIGH Voltage (Single−Ended)	3770		4110	3870		4190	3940		4280	mV
V_{IL}	Input LOW Voltage (Single−Ended)	3050		3500	3050		3520	3050		3555	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 5)	2.5		4.6	2.5		4.6	2.5		4.6	V
I_{IH}	Input HIGH Current		70	150		50	150		40	150	µA
I_{IL}	Input LOW Current	0.5	50		0.5	30		0.3	25		µA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

3. Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary +0.25 V / −0.5 V.
4. Outputs are terminated through a 50 Ω resistor to V_{CC} − 3.0 V.
5. V_{IHCMR} min varies 1:1 with V_{EE}. V_{IHCMR} max varies 1:1 with V_{CC}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal. Normal operation is obtained if the HIGH level falls within the specified range and the peak-to-peak voltage lies between V_{PP}min and 1 V.

Table 5. 10EL SERIES NECL DC CHARACTERISTICS V_{CC} = 0.0 V; V_{EE} = −5.0 V (Note 6)

Symbol	Characteristic	−40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		23	28		23	28		23	28	mA
V_{OH}	Output HIGH Voltage (Note 7)	−1.23	−1.10	−0.98	−1.13	−1.02	−0.90	−1.06	−0.96	−0.81	V
V_{OL}	Output LOW Voltage (Note 7)	−2.90	−2.72	−2.58	−3.00	−2.70	−2.56	−3.05	−2.67	−2.51	V
V_{IH}	Input HIGH Voltage (Single−Ended)	−1230		−890	−1130		−810	−1060		−720	mV
V_{IL}	Input LOW Voltage (Single−Ended)	−1950		−1500	−1950		−1480	−1950		−1445	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 8)	−2.5		−0.4	−2.5		−0.4	−2.5		−0.4	V
I_{IH}	Input HIGH Current		70	150		50	150		20	150	µA
I_{IL}	Input LOW Current	0.5	50		0.5	30		0.3	25		µA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

6. Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary +0.25 V / −0.5 V.
7. Outputs are terminated through a 50 Ω resistor to V_{CC} − 3.0 V.
8. V_{IHCMR} min varies 1:1 with V_{EE}. V_{IHCMR} max varies 1:1 with V_{CC}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal. Normal operation is obtained if the HIGH level falls within the specified range and the peak-to-peak voltage lies between V_{PP}min and 1 V.

Table 6. AC CHARACTERISTICS V_{CC} = 5.0 V; V_{EE} = 0.0 V or V_{CC} = 0.0 V; V_{EE} = −5.0 V (Note 9)

Symbol	Characteristic	−40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
f_{max}	Maximum Toggle Frequency					1.5					Gb/s
t_{PLH} t_{PHL}	Propagation Delay to Output	200	340	480	260	350	440	310	400	490	ps
t_{SKEW}	Within-Device Skew		5	20		5	20		5	20	ps
t_{JITTER}	Random Clock Jitter (RMS)		5			5			5		ps
V_{PP}	Input Swing (Note 10)	150			150	400		150			mV
t_r t_f	Output Rise/Fall Times Q (20% − 80%)	205	330	455	205	330	455	205	330	455	ps

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

9. V_{EE} can vary +0.25 V / −0.5 V.
10. $V_{PP(min)}$ is the minimum input swing for which AC parameters are guaranteed. The device has a DC gain of ≈ 40.
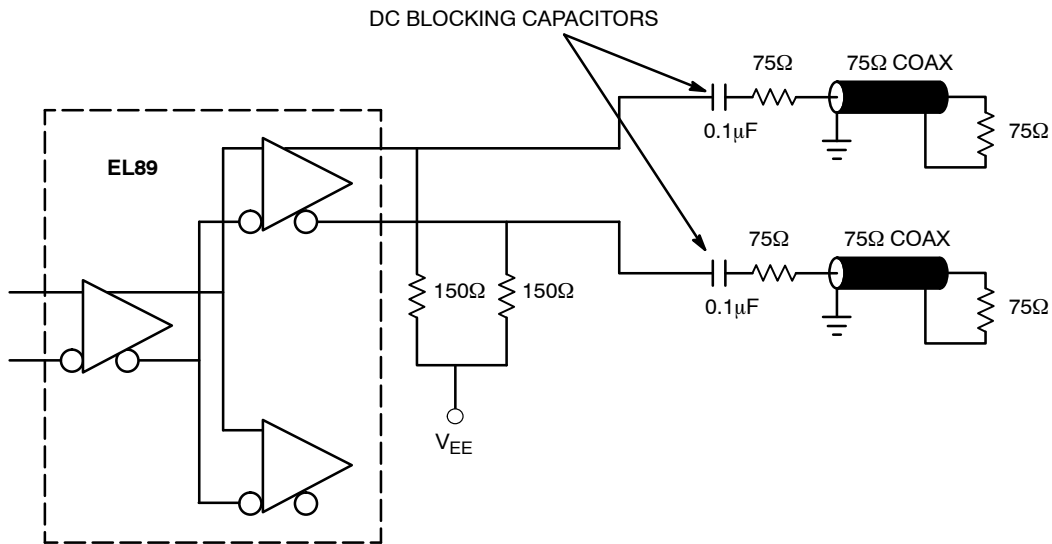
Figure 2. EL89 CATV Termination Configuration
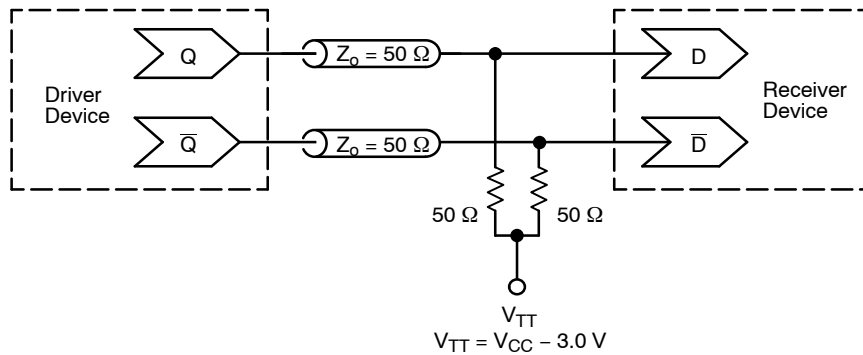
Figure 3. Typical Termination for Output Driver and Device Evaluation
(See Application Note AND8020/D − Termination of ECL Logic Devices.)

ORDERING INFORMATION

Device	Package	Shipping†
MC10EL89D	SOIC−8	98 Units / Rail
MC10EL89DG	SOIC−8 (Pb−Free)	98 Units / Rail
MC10EL89DR2	SOIC−8	2500 / Tape & Reel
MC10EL89DR2G	SOIC−8 (Pb−Free)	2500 / Tape & Reel
MC10EL89DT	TSSOP−8	100 Units / Rail
MC10EL89DTG	TSSOP−8 (Pb−Free)	100 Units / Rail
MC10EL89DTR2	TSSOP−8	2500 / Tape & Reel
MC10EL89DTR2G	TSSOP−8 (Pb−Free)	2500 / Tape & Reel
MC10EL89MNR4	DFN8	1000 / Tape & Reel
MC10EL89MNR4G	DFN8 (Pb−Free)	1000 / Tape & Reel

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

Resource Reference of Application Notes

AN1405/D − ECL Clock Distribution Techniques

AN1406/D − Designing with PECL (ECL at +5.0 V)

AN1503/D − ECLinPS™ I/O SPiCE Modeling Kit

AN1504/D − Metastability and the ECLinPS Family

AN1568/D − Interfacing Between LVDS and ECL

AN1672/D − The ECL Translator Guide

AND8001/D − Odd Number Counters Design

AND8002/D − Marking and Date Codes

AND8020/D − Termination of ECL Logic Devices

AND8066/D − Interfacing with ECLinPS

AND8090/D − AC Characteristics of ECL Devices

## PACKAGE DIMENSIONS

SOIC−8 NB
CASE 751−07
ISSUE AH
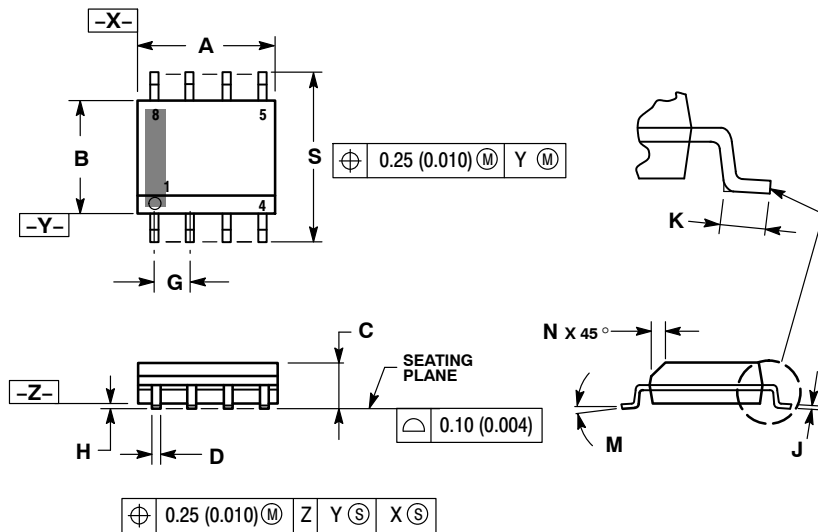
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

SOLDERING FOOTPRINT*
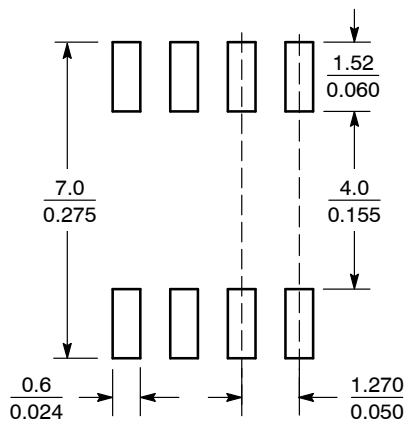
SCALE 6:1 $\left(\dfrac{mm}{inches}\right)$

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

MC10EL89

PACKAGE DIMENSIONS

TSSOP−8
DT SUFFIX
PLASTIC TSSOP PACKAGE
CASE 948R−02
ISSUE A
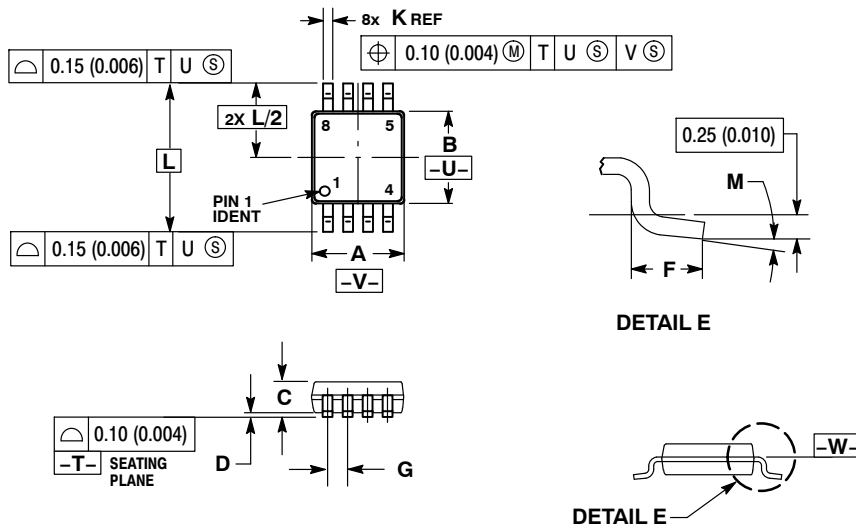
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
6. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE −W−.

DETAIL E

DETAIL E

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	2.90	3.10	0.114	0.122
C	0.80	1.10	0.031	0.043
D	0.05	0.15	0.002	0.006
F	0.40	0.70	0.016	0.028
G	0.65 BSC		0.026 BSC	
K	0.25	0.40	0.010	0.016
L	4.90 BSC		0.193 BSC	
M	0°	6°	0°	6°

PACKAGE DIMENSIONS

DFN8
CASE 506AA–01
ISSUE D

TOP VIEW

SIDE VIEW

BOTTOM VIEW
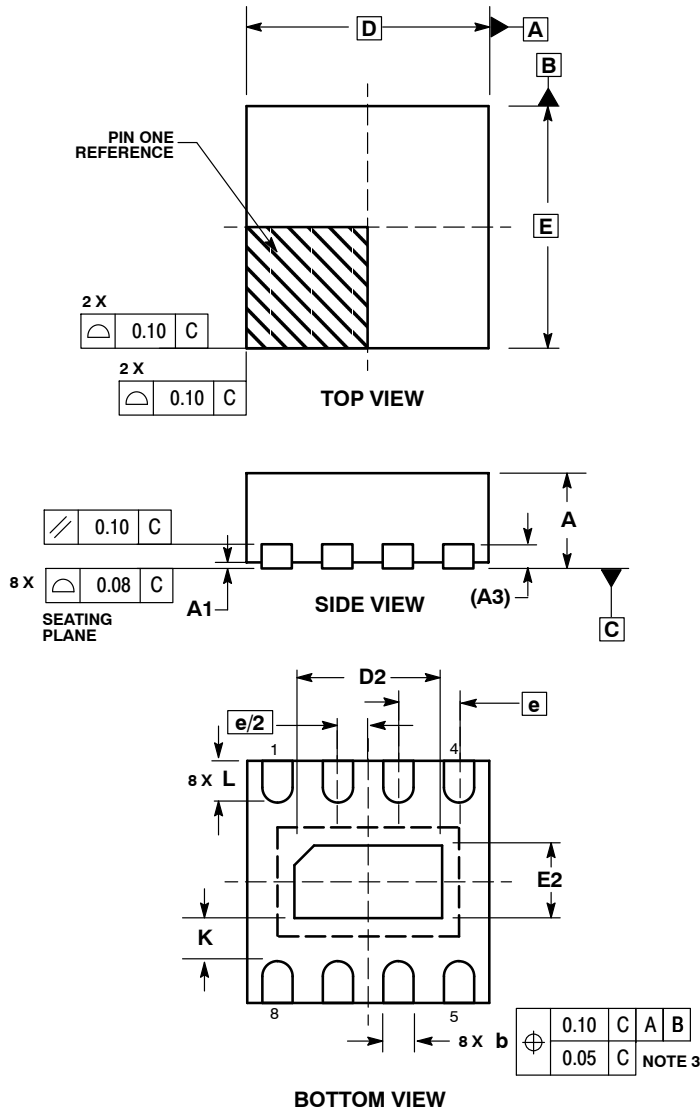
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994 .
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS MIN	MILLIMETERS MAX
A	0.80	1.00
A1	0.00	0.05
A3	0.20 REF	
b	0.20	0.30
D	2.00 BSC	
D2	1.10	1.30
E	2.00 BSC	
E2	0.70	0.90
e	0.50 BSC	
K	0.20	---
L	0.25	0.35

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PUBLICATION ORDERING INFORMATION