

# MC10EP89

## 3.3V / 5V ECL Coaxial Cable Driver

### Description

The MC10EP89 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 produces swings 70% larger than 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 (5 V) and 1.4 V (3.3 V) swing allow for termination at both ends of the cable, while maintaining a 800 mV (5 V) and 700 mV (3.3 V) swing at the receiving end of the cable. Because of the larger output swings, the device cannot be terminated into the standard  $V_{CC}-2.0$  V. All of the DC parameters are tested with a  $50\ \Omega$  to  $V_{CC}-3.0$  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

- 310 ps Typical Propagation Delay
- Maximum Frequency > 2 GHz Typical
- 1.6 V (5 V) and 1.4 V (3.3 V)  $V_{OUTpp}$  Swing
- PECL Mode Operating Range:  $V_{CC} = 3.0$  V to 5.5 V with  $V_{EE} = 0$  V
- NECL Mode Operating Range:  $V_{CC} = 0$  V with  $V_{EE} = -3.0$  V to  $-5.5$  V
- Open Input Default State
- Safety Clamp on Inputs
- Q Output Will Default LOW with Inputs Open or at  $V_{EE}$
- Pb-Free Packages are Available



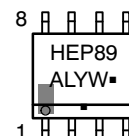
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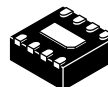
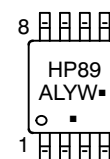
### MARKING DIAGRAMS\*



SOIC-8  
D SUFFIX  
CASE 751



TSSOP-8  
DT SUFFIX  
CASE 948R



DFN8  
MN SUFFIX  
CASE 506AA



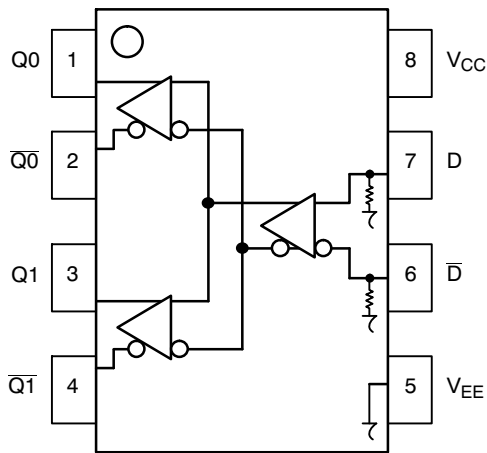
A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
D = Date Code  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

\*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 8 of this data sheet.

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**Table 1. PIN DESCRIPTION**

PIN	FUNCTION
D*, $\bar{D}$ *	ECL Data Inputs
Q0, Q1, $\bar{Q}$ 0, $\bar{Q}$ 1	ECL Data Outputs
V <sub>CC</sub>	Positive Supply
V <sub>EE</sub>	Negative Supply

\* Pins will default LOW when left open.

**Figure 1. 8-Lead Pinout (Top View) and Logic Diagram**

**Table 2. ATTRIBUTES**

Characteristics		Value	
Internal Input Pulldown Resistor		75 kΩ	
Internal Input Pullup Resistor		N/A	
ESD Protection	Human Body Model	> 4 kV	
	Machine Model	> 200 V	
	Charged Device Model	> 2 kV	
Moisture Sensitivity, Indefinite Time Out of Drypack (Note 1)	Pb Pkg	Level 1	Level 1
	Pb-Free Pkg	Level 1	Level 1
SOIC-8 TSSOP-8 DFN8	Level 1	Level 1	Level 1
	Level 1	Level 1	Level 3
	Level 1	Level 1	Level 1
Flammability Rating	Oxygen Index: 28 to 34	UL-94 V-0 @ 0.125 in	
Transistor Count	152 Devices		
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test			

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

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**Table 3. MAXIMUM RATINGS**

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V <sub>CC</sub>	PECL Mode Power Supply	V <sub>EE</sub> = 0 V		6	V
V <sub>EE</sub>	NECL Mode Power Supply	V <sub>CC</sub> = 0 V		-6	V
V <sub>I</sub>	PECL Mode Input Voltage	V <sub>EE</sub> = 0 V	V <sub>I</sub> ≤ V <sub>CC</sub>	6	V
	NECL Mode Input Voltage	V <sub>CC</sub> = 0 V	V <sub>I</sub> ≥ V <sub>EE</sub>	-6	V
I <sub>out</sub>	Output Current	Continuous Surge		50	mA
				100	mA
T <sub>A</sub>	Operating Temperature Range			-40 to +85	°C
T <sub>stg</sub>	Storage Temperature Range			-65 to +150	°C
θ <sub>JA</sub>	Thermal Resistance (Junction-to-Ambient)	0 lfpm	8 SOIC	190	°C/W
		500 lfpm	8 SOIC	130	°C/W
θ <sub>JC</sub>	Thermal Resistance (Junction-to-Case)	Standard Board	8 SOIC	41 to 44	°C/W
θ <sub>JA</sub>	Thermal Resistance (Junction-to-Ambient)	0 lfpm	8 TSSOP	185	°C/W
		500 lfpm	8 TSSOP	140	°C/W
θ <sub>JC</sub>	Thermal Resistance (Junction-to-Case)	Standard Board	8 TSSOP	41 to 44	°C/W
θ <sub>JA</sub>	Thermal Resistance (Junction-to-Ambient)	0 lfpm	DFN8	129	°C/W
		500 lfpm	DFN8	84	°C/W
T <sub>sol</sub>	Wave Solder	Pb Pb-Free	<2 to 3 sec @ 248°C <2 to 3 sec @ 260°C	265	°C
				265	°C

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.

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**Table 4. DC CHARACTERISTICS, PECL  $V_{CC} = 3.3\text{ V}$ ,  $V_{EE} = 0\text{ V}$  (Note 2)**

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Power Supply Current	24	30	36	26	34	40	30	36	42	mA
$V_{OH}$	Output HIGH Voltage (Note 3)	2130	2255	2405	2180	2336	2455	2200	2400	2475	mV
$V_{OL}$	Output LOW Voltage (Note 3)	500	784	1100	480	786	1100	440	882	1060	mV
$V_{IH}$	Input HIGH Voltage (Single-Ended)	2070		2410	2170		2490	2240		2580	mV
$V_{IL}$	Input LOW Voltage (Single-Ended)	1350		1800	1350		1820	1350		1855	mV
$V_{IHCMR}$	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 4)	2.0		3.3	2.0		3.3	2.0		3.3	V
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5			0.5			0.5			$\mu\text{A}$

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 lpm. 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.

2. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.3 V to -0.3 V.

3. All loading with 50  $\Omega$  to  $V_{CC} - 3.0\text{ V}$ .

4.  $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ , max varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

**Table 5. DC CHARACTERISTICS, PECL  $V_{CC} = 5.0\text{ V}$ ,  $V_{EE} = 0\text{ V}$  (Note 5)**

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Power Supply Current	27	34	41	30	37	44	33	40	47	mA
$V_{OH}$	Output HIGH Voltage (Note 6)	3830	3955	4105	3880	4037	4155	3900	4102	4175	mV
$V_{OL}$	Output LOW Voltage (Note 6)	1900	2205	2500	1850	2265	2450	1850	2177	2450	mV
$V_{IH}$	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 7)	2.0		5.0	2.0		5.0	2.0		5.0	V
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5			0.5			0.5			$\mu\text{A}$

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 lpm. 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.

5. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.5 V to -0.5 V.

6. All loading with 50  $\Omega$  to  $V_{CC} - 3.0\text{ V}$ .

7.  $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ , max varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

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**Table 6. DC CHARACTERISTICS, NECL**  $V_{CC} = 0\text{ V}$ ,  $V_{EE} = -3.3\text{ V}$  (Note 8)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Power Supply Current	24	30	36	26	34	40	30	36	42	mA
$V_{OH}$	Output HIGH Voltage (Note 9)	-1170	-1145	-895	-1120	-964	-845	-1100	-900	-825	mV
$V_{OL}$	Output LOW Voltage (Note 9)	-2800	-2516	-2200	-2820	-2514	-2220	-2860	-2478	-2240	mV
$V_{IH}$	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 10)	-1.3		0.0	-1.3		0.0	-1.3		0.0	V
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5			0.5			0.5			$\mu\text{A}$

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 lfm. 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.

8. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.3 V to -0.3 V.

9. All loading with 50  $\Omega$  to  $V_{CC} - 3.0\text{ V}$ .

10.  $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ , max varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

**Table 7. DC CHARACTERISTICS, NECL**  $V_{CC} = 0\text{ V}$ ,  $V_{EE} = -5.2$  (Note 11)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Power Supply Current	27	34	41	30	37	44	33	40	47	mA
$V_{OH}$	Output HIGH Voltage (Note 12)	-1170	-1045	-895	-1120	-964	-845	-1100	-900	-825	mV
$V_{OL}$	Output LOW Voltage (Note 12)	-3100	-2795	-2500	-3150	-2835	-2550	-3150	-2824	-2550	mV
$V_{IH}$	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 13)	-3.2		0.0	-3.2		0.0	-3.2		0.0	V
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5			0.5			0.5			$\mu\text{A}$

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 lfm. 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.

11. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.7 V to -0.3 V.

12. All loading with 50  $\Omega$  to  $V_{CC} - 3.0\text{ V}$ .

13.  $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ , max varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

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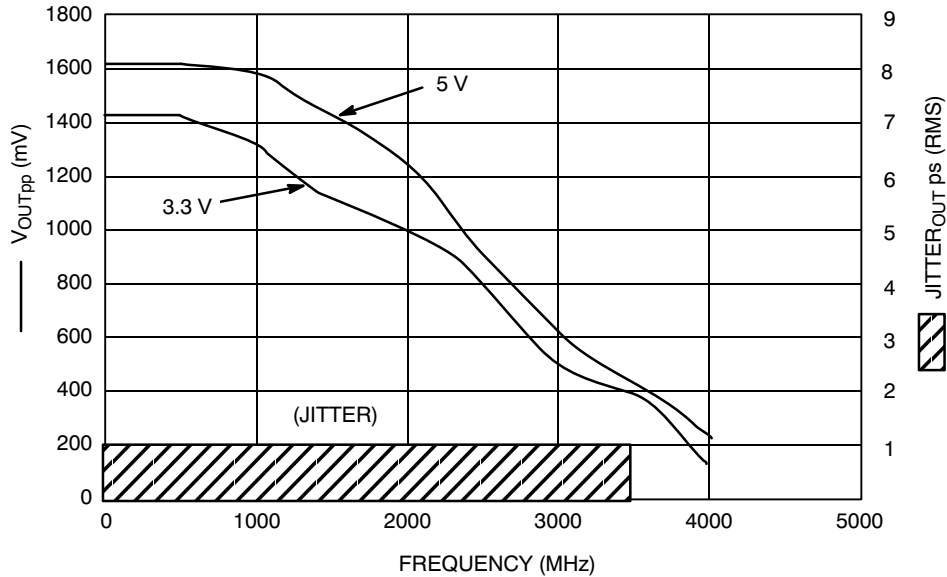
**Table 8. AC CHARACTERISTICS**  $V_{CC} = 0V$ ;  $V_{EE} = -3.0V$  to  $-5.5V$  or  $V_{CC} = 3.0V$  to  $5.5V$ ;  $V_{EE} = 0V$  (Note 14)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$f_{max}$	Maximum Toggle (See Figure 2 $F_{max}/JITTER$ )		> 2			> 2			> 2		GHz
$t_{PLH}$ , $t_{PHL}$	Propagation Delay to Output Differential	220	280	340	250	310	370	270	330	390	ps
$t_{SKEW}$	Within Device Skew $Q, \bar{Q}$ Device to Device Skew (Note 15)		5.0	20 120		5.0	20 120		5.0	20 120	ps
$t_{JITTER}$	Cycle-to-Cycle Jitter (See Figure 2 $F_{max}/JITTER$ )		.5	< 1		.5	< 1		.5	< 1	ps
$V_{PP}$	Input Voltage Swing (Differential Configuration)	150	800	1200	150	800	1200	150	800	1200	mV
$t_r$ , $t_f$	Output Rise/Fall Times $Q, \bar{Q}$ (20% - 80%)	175	250	325	200	275	350	225	295	375	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.

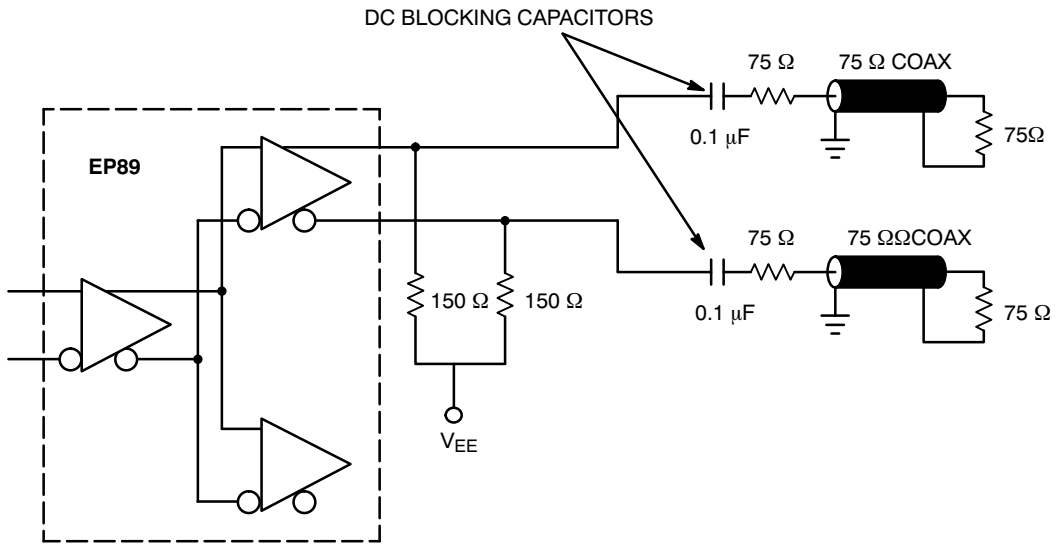
14. Measured using a 750 mV source, 50% duty cycle clock source. All loading with  $50\ \Omega$  to  $V_{CC} = -3.0V$ .

15. Skew is measured between outputs under identical transitions.

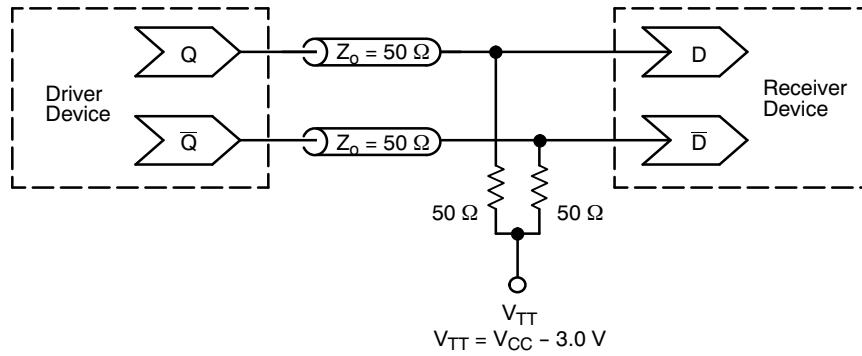


**Figure 2.  $F_{max}/Jitter$**

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**Figure 3. Cable Driver Termination Configuration**



**Figure 4. Typical Termination for Output Driver and Device Evaluation  
(See Application Note AND8020/D – Termination of ECL Logic Devices.)**

# MC10EP89

## ORDERING INFORMATION

Device	Package	Shipping†
MC10EP89D	SOIC-8	98 Units / Rail
MC10EP89DG	SOIC-8 (Pb-Free)	98 Units / Rail
MC10EP89DR2	SOIC-8	2500 / Tape & Reel
MC10EP89DR2G	SOIC-8 (Pb-Free)	2500 / Tape & Reel
MC10EP89DT	TSSOP-8	100 Units / Rail
MC10EP89DTG	TSSOP-8 (Pb-Free)	100 Units / Rail
MC10EP89DTR2	TSSOP-8	2500 / Tape & Reel
MC10EP89DTR2G	TSSOP-8 (Pb-Free)	2500 / Tape & Reel
MC10EP89MNR4	DFN8	1000 / Tape & Reel
MC10EP89MNR4G	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

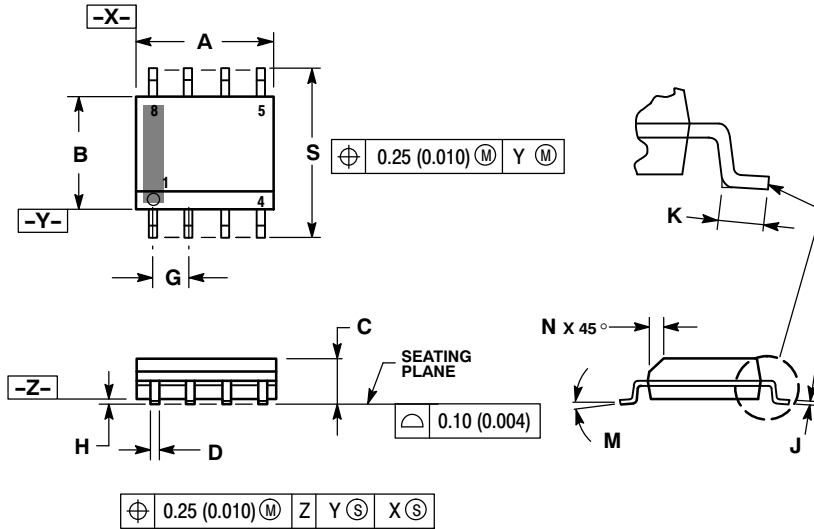
- AN1405/D** - ECL Clock Distribution Techniques
- AN1406/D** - Designing with PECL (ECL at +5.0 V)
- AN1503/D** - ECLinPS™ I/O SPICE Modeling Kit
- AN1504/D** - Metastability and the ECLinPS Family
- AN1568/D** - Interfacing Between LVDS and ECL
- AN1642/D** - The ECL Translator Guide
- AND8001/D** - 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



# MC10EP89

## PACKAGE DIMENSIONS

SOIC-8 NB  
CASE 751-07  
ISSUE AJ

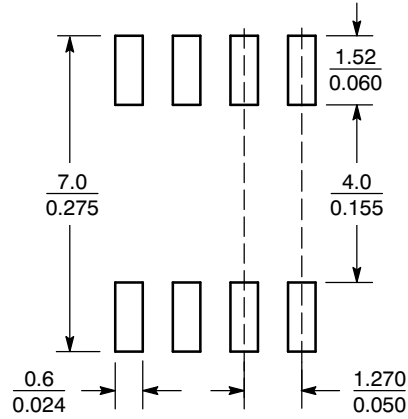


NOTES:

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\*



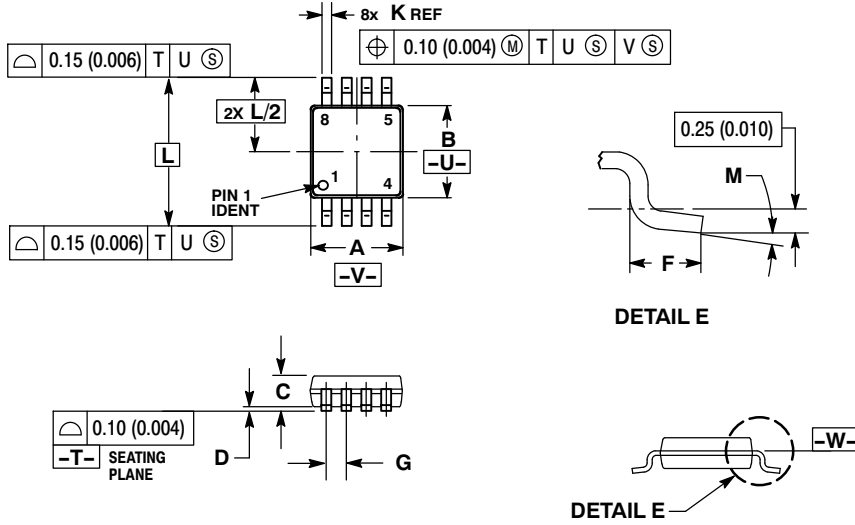
SCALE 6:1 ( $\frac{\text{mm}}{\text{inches}}$ )

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

# MC10EP89

## PACKAGE DIMENSIONS

TSSOP-8  
DT SUFFIX  
PLASTIC TSSOP PACKAGE  
CASE 948R-02  
ISSUE A



### NOTES:

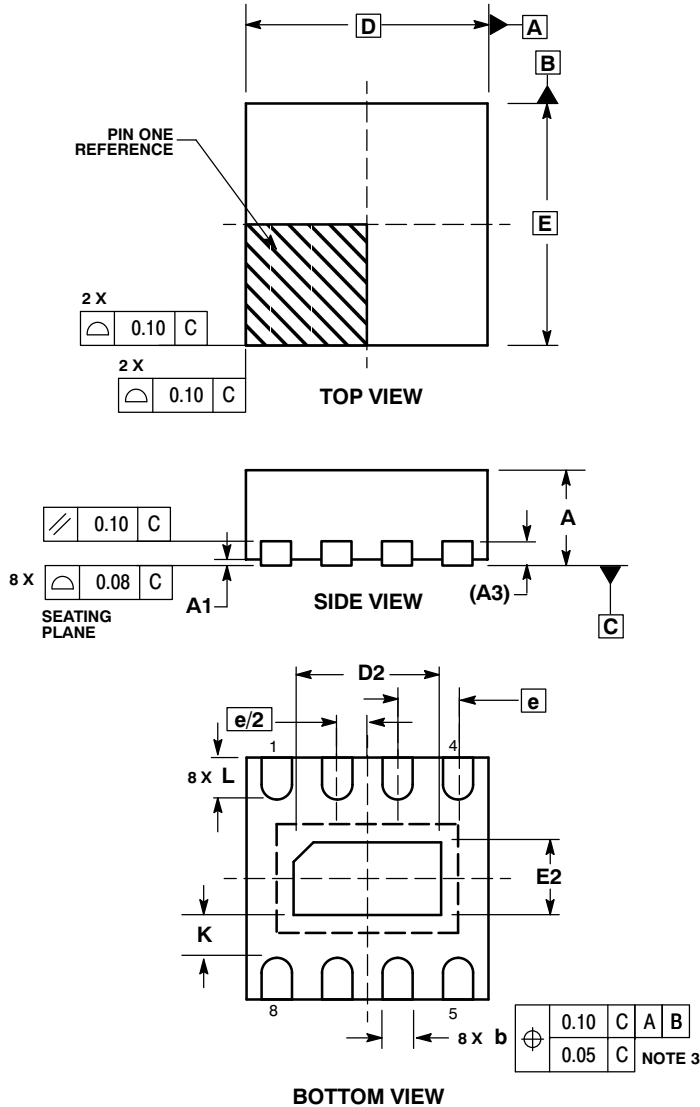
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD 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-.

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°

# MC10EP89

## PACKAGE DIMENSIONS

DFN8  
CASE 506AA-01  
ISSUE D



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	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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