

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



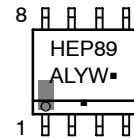
ON Semiconductor®

<http://onsemi.com>

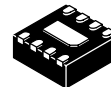
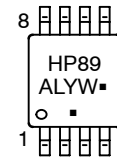
MARKING DIAGRAMS*



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.

MC10EP89

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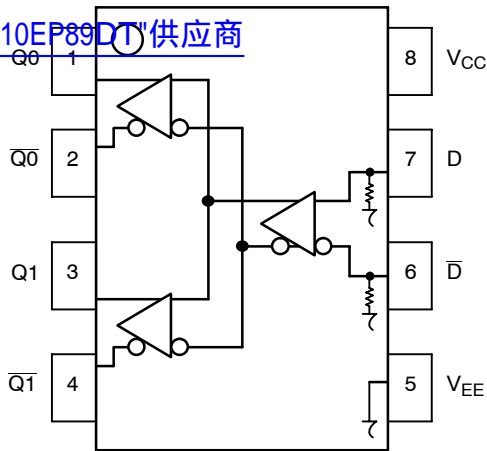


Table 1. PIN DESCRIPTION

| PIN | FUNCTION |
|----------------------------------|------------------|
| D*, \bar{D} * | ECL Data Inputs |
| Q0, Q1, \bar{Q} 0, \bar{Q} 1 | ECL Data Outputs |
| V _{CC} | Positive Supply |
| V _{EE} | 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 k Ω | |
| 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 | Pb-Free Pkg |
| | SOIC-8 | Level 1 | Level 1 |
| | TSSOP-8 | Level 1 | Level 3 |
| | DFN8 | 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.

MC10EP89

Table 8. MAXIMUM RATINGS

| Symbol | Parameter | Condition 1 | Condition 2 | Rating | Unit |
|---------------|--|-----------------------|--|-------------|------|
| V_{CC} | PECL Mode Power Supply | $V_{EE} = 0\text{ V}$ | | 6 | V |
| V_{EE} | NECL Mode Power Supply | $V_{CC} = 0\text{ V}$ | | -6 | V |
| V_I | PECL Mode Input Voltage | $V_{EE} = 0\text{ V}$ | $V_I \leq V_{CC}$ | 6 | V |
| | NECL Mode Input Voltage | $V_{CC} = 0\text{ V}$ | $V_I \geq V_{EE}$ | -6 | V |
| I_{out} | Output Current | Continuous Surge | | 50 | mA |
| | | | | 100 | 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 | 8 SOIC | 190 | °C/W |
| | | 500 lfpm | 8 SOIC | 130 | °C/W |
| θ_{JC} | Thermal Resistance (Junction-to-Case) | Standard Board | 8 SOIC | 41 to 44 | °C/W |
| θ_{JA} | Thermal Resistance (Junction-to-Ambient) | 0 lfpm | 8 TSSOP | 185 | °C/W |
| | | 500 lfpm | 8 TSSOP | 140 | °C/W |
| θ_{JC} | Thermal Resistance (Junction-to-Case) | Standard Board | 8 TSSOP | 41 to 44 | °C/W |
| θ_{JA} | Thermal Resistance (Junction-to-Ambient) | 0 lfpm | DFN8 | 129 | °C/W |
| | | 500 lfpm | DFN8 | 84 | °C/W |
| T_{sol} | Wave Solder | Pb Pb-Free | <2 to 3 sec @ 248°C <2 to 3 sec @ 260°C | 265 | °C |
| | | | | 265 | °C |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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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 | μA |
| I_{IL} | Input LOW Current | 0.5 | | | 0.5 | | | 0.5 | | | 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.

- Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary +0.3 V to -0.3 V.
- All loading with $50\ \Omega$ to $V_{CC} - 3.0\text{ V}$.
- 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 | μA |
| I_{IL} | Input LOW Current | 0.5 | | | 0.5 | | | 0.5 | | | 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.

- Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary +0.5 V to -0.5 V.
- All loading with $50\ \Omega$ to $V_{CC} - 3.0\text{ V}$.
- 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 | μA |
| I_{IL} | Input LOW Current | 0.5 | | | 0.5 | | | 0.5 | | | 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.

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 Ω 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 | μA |
| I_{IL} | Input LOW Current | 0.5 | | | 0.5 | | | 0.5 | | | 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.

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 Ω 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 Ω to $V_{CC}-3.0V$.

15. Skew is measured between outputs under identical transitions.

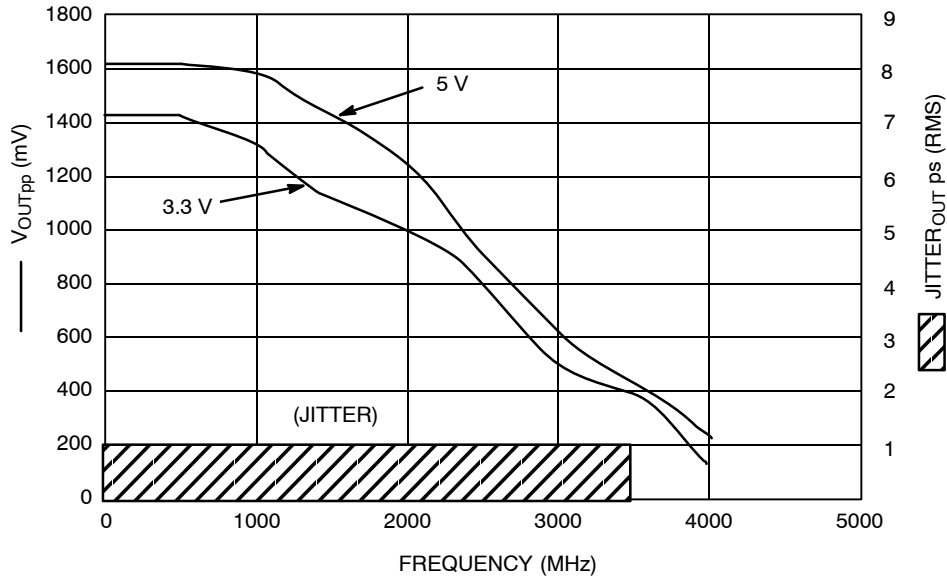


Figure 2. $F_{max}/Jitter$

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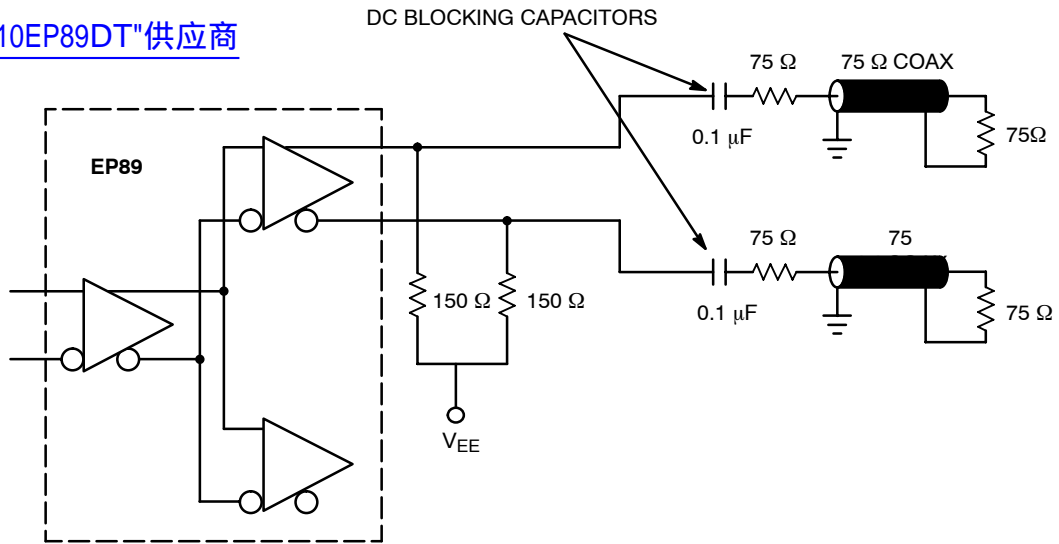


Figure 3. Cable Driver Termination Configuration

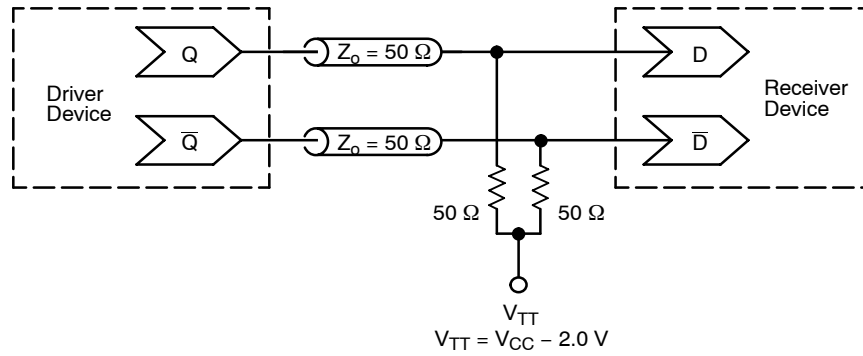


Figure 4. Typical Termination for Output Driver and Device Evaluation
(See Application Note AND8020/D – Termination of ECL Logic Devices.)

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

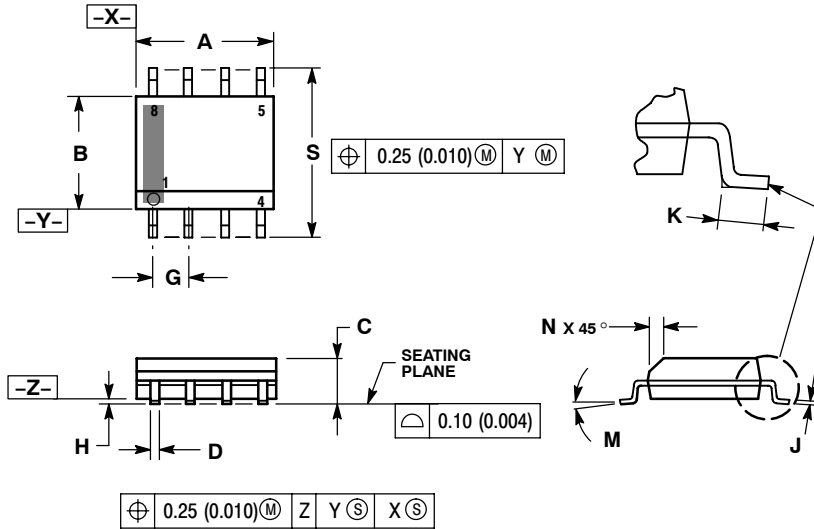
- AN1405/D** – ECL Clock Distribution Techniques
- AN1406/D** – Designing with PECL (ECL at +5.0 V)
- AN1503/D** – ECLinPS™ I/O SPiCE Modeling Kit
- AN1504/D** – Metastability and the ECLinPS Family
- AN1568/D** – Interfacing Between LVDS and ECL
- AN1642/D** – The ECL Translator Guide
- AND8001/D**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

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PACKAGE DIMENSIONS

SOIC-8 NB
CASE 751-07
ISSUE AG

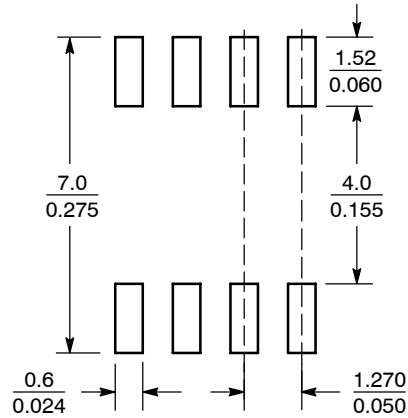


NOTES:

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 (mm/inches)

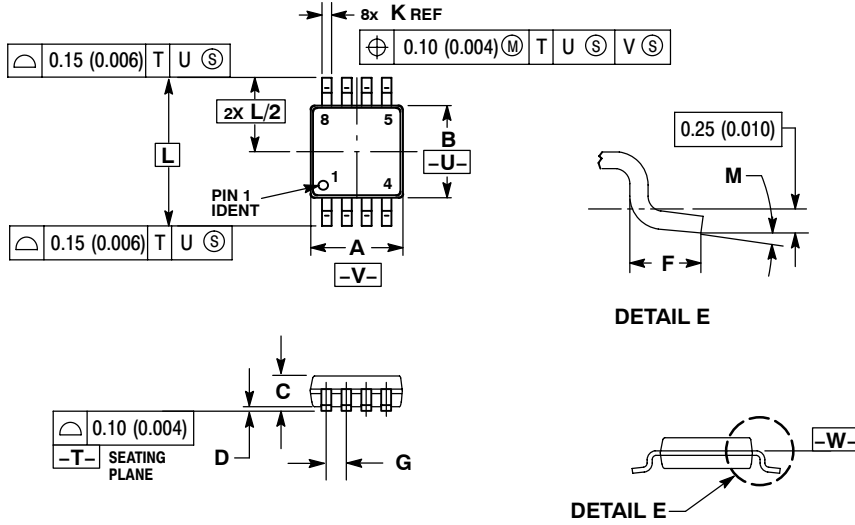
*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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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-.

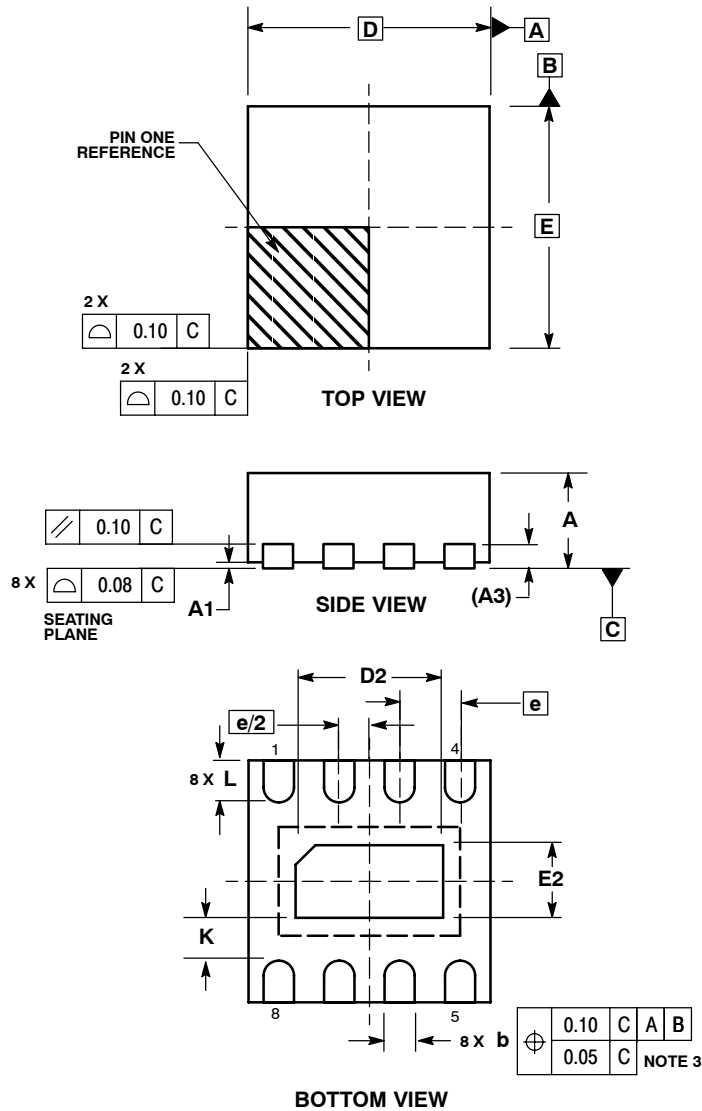
| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 2.90 | 3.10 | 0.114 | 0.122 |
| B | 2.90 | 3.10 | 0.114 | 0.122 |
| C | 0.80 | 1.10 | 0.031 | 0.043 |
| D | 0.05 | 0.15 | 0.002 | 0.006 |
| F | 0.40 | 0.70 | 0.016 | 0.028 |
| G | 0.65 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

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PACKAGE DIMENSIONS

DFN8
CASE 506AA-01
ISSUE C



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.

| MILLIMETERS | | |
|-------------|----------|------|
| DIM | 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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