**MOTOROLA**
*Semiconductor Components*

**Order Number: MC10EP33/D**
**Rev. 0.2, 06/1999**

# MC10EP33

**SO–8, D SUFFIX**
8–LEAD PLASTIC SOIC PACKAGE
CASE 751

**ORDERING INFORMATION**
MC10EP33D SOIC

ECLinPS Plus™

*Product Preview*

## ÷4 Divider

- 440ps Propagation Delay
- >4 GHz Toggle Frequency
- High Bandwidth Output Transistors
- PECL mode: 3.0V to 5.5V $V_{CC}$ with $V_{EE}$ = 0V
- ECL mode: 0V $V_{CC}$ with $V_{EE}$ = –3.0V to –5.5V
- Internal Input Resistors: Pulldown on D, $\overline{D}$
- Q Output will default LOW with inputs open or at $V_{EE}$
- ESD Protection: >4KV HBM, >200V MM
- $V_{BB}$ Output
- New Differential Input Common Mode Range
- Moisture Sensitivity Level 1, Indefinite Time Out of Drypack
- Flammability Rating: UL–94 code V–0 @ 1/8”, Oxygen Index 28 to 34
- Transistor Count = 91 devices

**PIN DESCRIPTION**

| PIN | FUNCTION |
|---|---|
| CLK | ECL Clock Inputs |
| Reset | ECL Asynch Reset |
| $V_{BB}$ | Ref Voltage Output |
| Q / $\overline{Q}$ | ECL Data Outputs |

**TRUTH TABLE**

| CLK | $\overline{CLK}$ | RESET | Q | $\overline{Q}$ |
|---|---|---|---|---|
| X | X | Z | L | H |
| Z | $\overline{Z}$ | L | F | F |

Z = LOW to HIGH Transition
$\overline{Z}$ = HIGH to LOW Transition
F = Divide by 4 Function

The MC10EP33 is an integrated ÷4 divider. The differential clock inputs and the $V_{BB}$ allow a differential, single–ended or AC coupled interface to the device. If used, the $V_{BB}$ output should be bypassed to ground with a 0.01μF capacitor.

The reset pin is asynchronous and is asserted on the rising edge. Upon power–up, the internal flip–flops will attain a random state; the reset allows for the synchronization of multiple EP33’s in a system.

This document contains information on a product under development. Motorola reserves the right to change or discontinue this product without notice.





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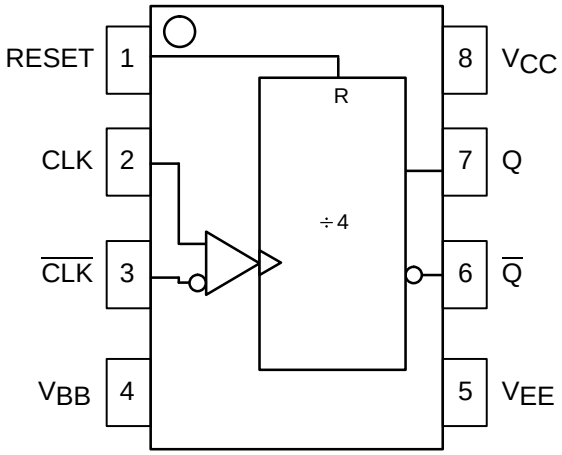



**Figure 1. 8–Lead Pinout** (Top View) **and Logic Diagram**

**MAXIMUM RATINGS***

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{EE}$ | Power Supply ($V_{CC}$ = 0V) | –6.0 to 0 | VDC |
| $V_{CC}$ | Power Supply ($V_{EE}$ = 0V) | 6.0 to 0 | VDC |
| $V_I$ | Input Voltage ($V_{CC}$ = 0V, $V_I$ not more negative than $V_{EE}$) | –6.0 to 0 | VDC |
| $V_I$ | Input Voltage ($V_{EE}$ = 0V, $V_I$ not more positive than $V_{CC}$) | 6.0 to 0 | VDC |
| $I_{out}$ | Output Current — Continuous<br>Surge | 50<br>100 | mA |
| $I_{BB}$ | $V_{BB}$ Sink/Source Current† | ± 0.5 | mA |
| $T_A$ | Operating Temperature Range | –40 to +85 | °C |
| $T_{stg}$ | Storage Temperature | –65 to +150 | °C |
| $\theta_{JA}$ | Thermal Resistance (Junction–to–Ambient) — Still Air<br>500lfpm | 190<br>130 | °C/W |
| $\theta_{JC}$ | Thermal Resistance (Junction–to–Case) | 41 to 44 ± 5% | °C/W |
| $T_{sol}$ | Solder Temperature (<2 to 3 Seconds: 245°C desired) | 265 | °C |

* Maximum Ratings are those values beyond which damage to the device may occur.

† Use for inputs of same package only.

**DC CHARACTERISTICS, ECL/LVECL** ($V_{CC}$ = 0V; $V_{EE}$ = –5.5V to –3.0V) (Note 4.)

| | | –40°C | | | 25°C | | | 85°C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Symbol** | **Characteristic** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Unit** |
| IEE | Power Supply Current (Note 1.) | TBD | TBD | TBD | TBD | 27.5 | TBD | TBD | TBD | TBD | mA |
| $V_{OH}$ | Output HIGH Voltage (Note 2.) | –1135 | –1060 | –885 | –1070 | –945 | –820 | –1010 | –885 | –760 | mV |
| $V_{OL}$ | Output LOW Voltage (Note 2.) | –1935 | –1810 | –1685 | –1870 | –1745 | –1620 | –1810 | –1685 | –1560 | mV |
| $V_{IH}$ | Input HIGH Voltage Single Ended | –1210 | | –885 | –1145 | | –820 | –1085 | | –760 | mV |
| $V_{IL}$ | Input LOW Voltage Single Ended | –1935 | | –1610 | –1870 | | –1545 | –1810 | | –1485 | mV |
| $V_{BB}$ | Output Voltage Reference | –1510 | –1410 | –1310 | –1445 | –1345 | –1245 | –1385 | –1285 | –1185 | mV |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range (Note 3.) | $V_{EE}$+2.0 | | 0.0 | $V_{EE}$+2.0 | | 0.0 | $V_{EE}$+2.0 | | 0.0 | V |
| $I_{IH}$ | Input HIGH Current | | | 150 | | | 150 | | | 150 | µA |
| $I_{IL}$ | Input LOW Current CLK<br>$\overline{CLK}$ | 0.5<br>–150 | | | 0.5<br>–150 | | | 0.5<br>–150 | | | µA |

NOTE: 10EP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse airflow greater than 500lfpm is maintained.

1. $V_{CC}$ = 0V, $V_{EE}$ = $V_{EEmin}$ to $V_{EEmax}$, all other pins floating.
2. All loading with 50 ohms to $V_{CC}$–2.0 volts.
3. $V_{IHCMR}$ min varies 1:1 with $V_{EE}$, max varies 1:1 with $V_{CC}$.
4. Input and output parameters vary 1:1 with $V_{CC}$.

**DC CHARACTERISTICS, LVPECL** ($V_{CC}$ = 3.3V ± 0.3V, $V_{EE}$ = 0V) (Note 8.)

| | | –40°C | | | 25°C | | | 85°C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Symbol** | **Characteristic** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Unit** |
| IEE | Power Supply Current (Note 5.) | TBD | TBD | TBD | TBD | 27.5 | TBD | TBD | TBD | TBD | mA |
| $V_{OH}$ | Output HIGH Voltage (Note 6.) | 2165 | 2240 | 2415 | 2230 | 2355 | 2480 | 2290 | 2415 | 2540 | mV |
| $V_{OL}$ | Output LOW Voltage (Note 6.) | 1365 | 1490 | 1615 | 1430 | 1555 | 1680 | 1490 | 1615 | 1740 | mV |
| $V_{IH}$ | Input HIGH Voltage Single Ended | 2090 | | 2415 | 2155 | | 2480 | 2215 | | 2540 | mV |
| $V_{IL}$ | Input LOW Voltage Single Ended | 1365 | | 1690 | 1430 | | 1755 | 1490 | | 1815 | mV |
| $V_{BB}$ | Output Voltage Reference | 1790 | 1890 | 1990 | 1855 | 1955 | 2055 | 1915 | 2015 | 2115 | mV |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range (Note 7.) | 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 CLK<br>$\overline{CLK}$ | 0.5<br>–150 | | | 0.5<br>–150 | | | 0.5<br>–150 | | | µA |

NOTE: 10EP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse airflow greater than 500lfpm is maintained.

5. $V_{CC}$ = 3.3V, $V_{EE}$ = 0V, all other pins floating.
6. All loading with 50 ohms to $V_{CC}$–2.0 volts.
7. $V_{IHCMR}$ min varies 1:1 with $V_{EE}$, max varies 1:1 with $V_{CC}$.
8. Input and output parameters vary 1:1 with $V_{CC}$.

**DC CHARACTERISTICS, PECL** ($V_{CC}$ = 5.0V ± 0.5V, $V_{EE}$ = 0V) (Note 12.)

| | | –40°C | | | 25°C | | | 85°C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Symbol** | **Characteristic** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Unit** |
| $I_{EE}$ | Power Supply Current (Note 9.) | TBD | TBD | TBD | TBD | 27.5 | TBD | TBD | TBD | TBD | mA |
| $V_{OH}$ | Output HIGH Voltage (Note 10.) | 3865 | 3940 | 4115 | 3930 | 4055 | 4180 | 3990 | 4115 | 4240 | mV |
| $V_{OL}$ | Output LOW Voltage (Note 10.) | 3065 | 3190 | 3315 | 3130 | 3255 | 3380 | 3190 | 3315 | 3440 | mV |
| $V_{IH}$ | Input HIGH Voltage Single Ended | 3790 | | 4115 | 3855 | | 4180 | 3915 | | 4240 | mV |
| $V_{IL}$ | Input LOW Voltage Single Ended | 3065 | | 3390 | 3130 | | 3455 | 3190 | | 3515 | mV |
| $V_{BB}$ | Output Voltage Reference | 3490 | 3590 | 3690 | 3555 | 3655 | 3755 | 3615 | 3715 | 3815 | mV |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range (Note 11.) | 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 CLK<br>$\overline{CLK}$ | 0.5<br>–150 | | | 0.5<br>–150 | | | 0.5<br>–150 | | | µA |

NOTE: 10EP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse airflow greater than 500lfpm is maintained.

9. $V_{CC}$ = 5.0V, $V_{EE}$ = 0V, all other pins floating.
10. All loading with 50 ohms to $V_{CC}$–2.0 volts.
11. $V_{IHCMR}$ min varies 1:1 with $V_{EE}$, max varies 1:1 with $V_{CC}$.
12. Input and output parameters vary 1:1 with $V_{CC}$.

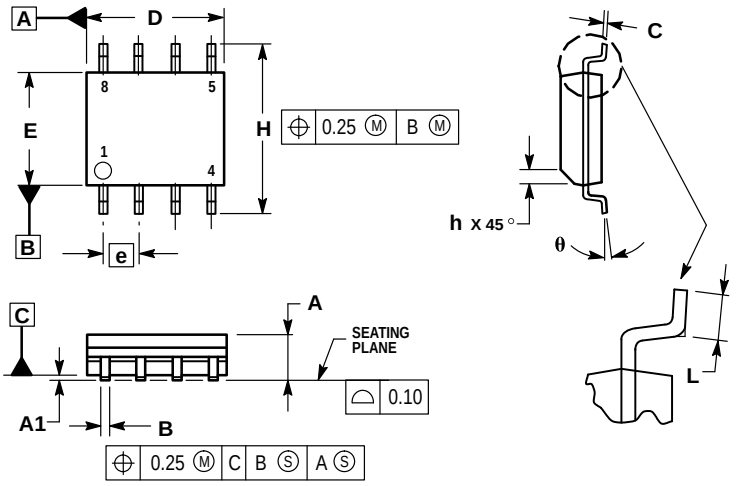
**AC CHARACTERISTICS** ($V_{CC}$ = 0V; $V_{EE}$ = –3.0V to –5.5V) or ($V_{CC}$ = 3.0V to 5.5V; $V_{EE}$ = 0V)

| | | –40°C | | | 25°C | | | 85°C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Symbol** | **Characteristic** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Unit** |
| $f_{max}$ | Maximum Toggle Frequency (Note 13.) | TBD | | | TBD | >4 | | TBD | | | GHz |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay to Output Differential | | 160 | | | 160 | | | 160 | | ps |
| $t_{RR}$ | Set/Reset Recovery | | TBD | | | TBD | | | TBD | | ps |
| $t_{SKEW}$ | Duty Cycle Skew (Note 14.) | | 5.0 | | | 5.0 | 20 | | 5.0 | 20 | ps |
| $t_{PW}$ | Minimum Pulse Width RESET | | TBD | | | TBD | | | TBD | | ps |
| $t_{JITTER}$ | Cycle–to–Cycle Jitter | | TBD | | | TBD | | | TBD | | ps |
| $V_{PP}$ | Input Voltage Swing (Diff.) | 150 | 800 | 1200 | 150 | 800 | 1200 | 150 | 800 | 1200 | mV |
| $t_r$<br>$t_f$ | Output Rise/Fall Times (20% – 80%) Q, $\overline{Q}$ | | TBD<br>TBD | | | TBD<br>TBD | | | TBD<br>TBD | | ps |

13. $F_{max}$ guaranteed for functionality only. $V_{OL}$ and $V_{OH}$ levels are guaranteed at DC only.
14. Skew is measured between outputs under identical transitions. Duty cycle skew is defined only for differential operation when the delays are measured from the cross point of the inputs to the cross point of the outputs.

## OUTLINE DIMENSIONS

**SO–8, D SUFFIX**
PLASTIC SOIC PACKAGE
CASE 751–06
ISSUE T




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETER.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | 1.35 | 1.75 |
| A1 | 0.10 | 0.25 |
| B | 0.35 | 0.49 |
| C | 0.19 | 0.25 |
| D | 4.80 | 5.00 |
| E | 3.80 | 4.00 |
| e | 1.27 BSC | |
| H | 5.80 | 6.20 |
| h | 0.25 | 0.50 |
| L | 0.40 | 1.25 |
| θ | 0° | 7° |



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