

## 3.3 V/5 V ECL 6-Bit Differential Register with Master Reset

### MC10EP451, MC100EP451

#### Description

The MC10/100EP451 is a 6-bit fully differential register with common clock and single-ended Master Reset (MR). It is ideal for very high frequency applications where a registered data path is necessary.

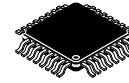
All inputs have a 75 k $\Omega$  pulldown resistor internally. Differential inputs have an override clamp. Unused differential register inputs can be left open and will default LOW. When the differential inputs are forced to  $< V_{EE} + 1.2$  V, the clamp will override and force the output to a default state. When in the default state, and since the flip-flop is edge triggered, the output reaches a determined, but not predicted, valid state.

The positive transition of CLK (pin 4) will latch the registers. Master Reset (MR) HIGH will asynchronously reset all registers forcing Q outputs to go LOW.

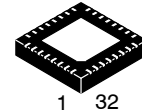
The 100 Series contains temperature compensation.

#### Features

- 450 ps Typical Propagation Delay
- Maximum Frequency > 3.0 GHz Typical
- Asynchronous Master Reset
- 20 ps Skew Within Device, 35 ps Skew Device-To-Device
- 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
- These Devices are Pb-Free and are RoHS Compliant

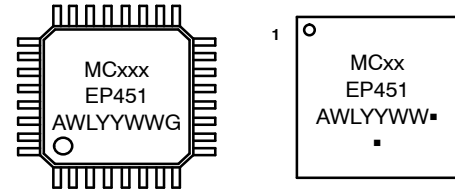


LQFP-32  
FA SUFFIX  
CASE 561AB



QFN32  
MN SUFFIX  
CASE 488AM

#### MARKING DIAGRAM



xxx = 10 or 100  
A = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week  
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

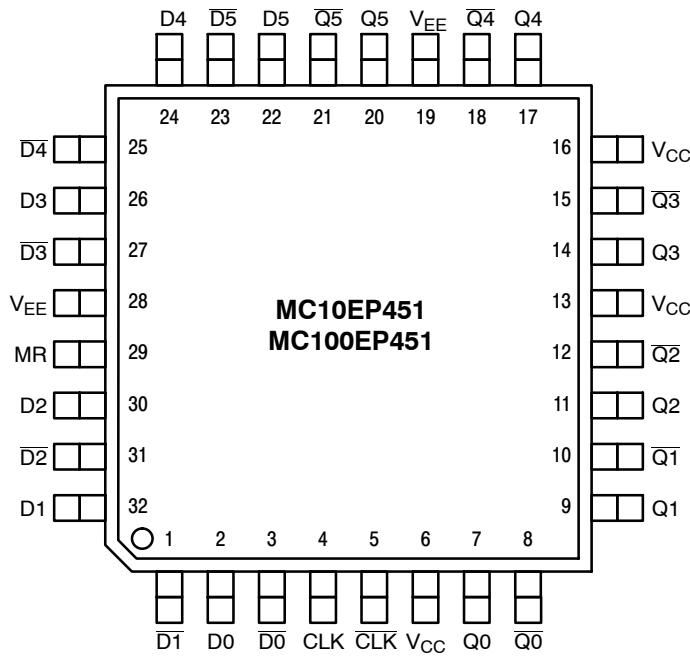
\*For additional marking information, refer to Application Note [AND8002/D](#).

#### ORDERING INFORMATION

| Device          | Package           | Shipping <sup>†</sup> |
|-----------------|-------------------|-----------------------|
| MC10EP451FAG    | LQFP-32 (Pb-Free) | 250 Units / Tube      |
| MC100EP451FAG   | LQFP-32 (Pb-Free) | 250 Units / Tube      |
| MC100EP451FAR2G | LQFP-32 (Pb-Free) | 2000 / Tape & Reel    |
| MC100EP451MNG   | QFN-32 (Pb-Free)  | 72 Units / Tube       |
| MC100EP451MNR4G | QFN-32 (Pb-Free)  | 1000 / Tape & Reel    |

<sup>†</sup>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](#).

# MC10EP451, MC100EP451



Warning: All  $V_{CC}$  and  $V_{EE}$  pins must be externally connected to Power Supply to guarantee proper operation.

Figure 1. LQFP-32 Pinout (Top View)

Table 1. PIN DESCRIPTION

| PIN                        | FUNCTION                                                                                                                                                                                                                                   |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| D [0:5]*, $\bar{D}$ [0:5]* | ECL Differential Data Inputs                                                                                                                                                                                                               |
| MR*                        | ECL Master Reset Input                                                                                                                                                                                                                     |
| CLK*, $\bar{CLK}$ *        | ECL Differential Clock Inputs                                                                                                                                                                                                              |
| Q [0:5], $\bar{Q}$ [0:5]   | ECL Differential Data Outputs                                                                                                                                                                                                              |
| $V_{CC}$                   | Positive Supply                                                                                                                                                                                                                            |
| $V_{EE}$                   | Negative Supply                                                                                                                                                                                                                            |
| EP for QFN-32, only        | The Exposed Pad (EP) on the QFN-32 package bottom is thermally connected to the die for improved heat transfer out of package. The exposed pad must be attached to a heat-sinking conduit. The pad is electrically connected to $V_{EE}$ . |

\* Pins will default LOW when left open.

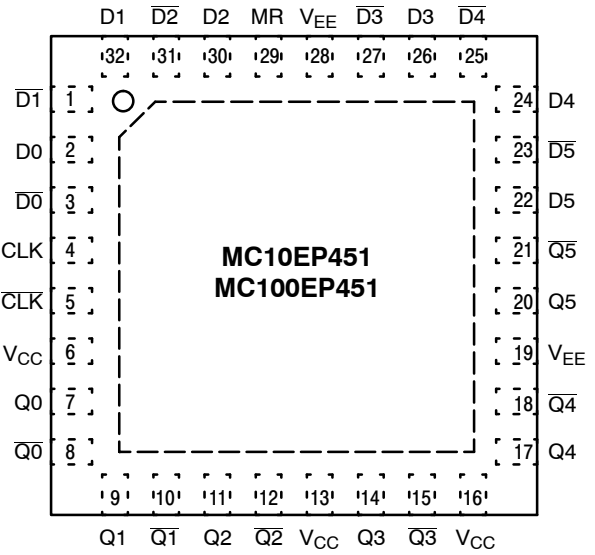


Figure 2. QFN-32 Pinout (Top View)

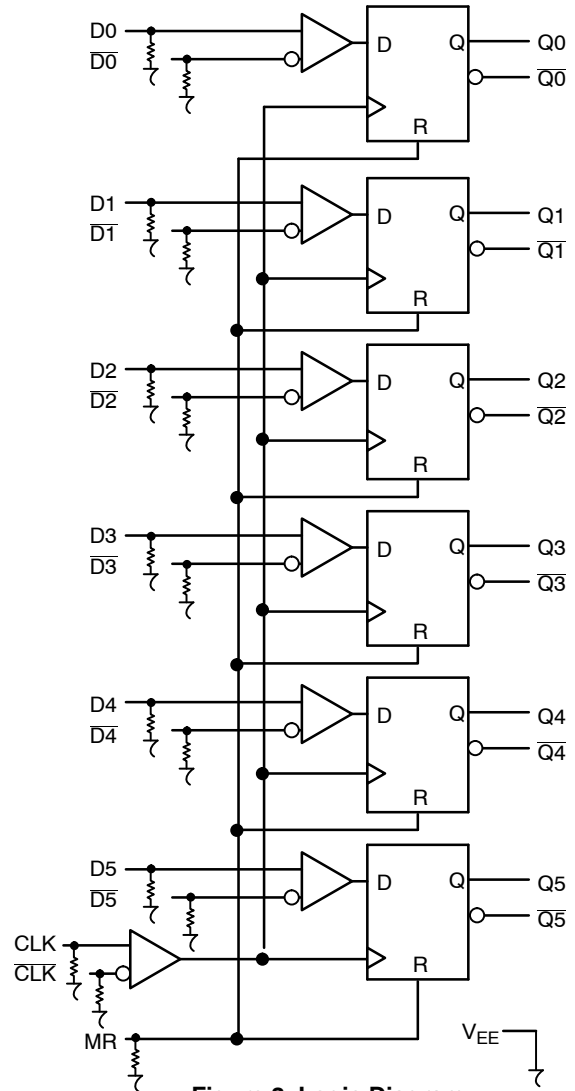


Figure 3. Logic Diagram

# MC10EP451, MC100EP451

**Table 2. ATTRIBUTES**

| Characteristics                                                             | Value                       |
|-----------------------------------------------------------------------------|-----------------------------|
| Internal Input Pulldown Resistor                                            | 75 k $\Omega$               |
| Internal Input Pullup Resistor                                              | N/A                         |
| ESD Protection<br>Human Body Model<br>Machine Model<br>Charged Device Model | > 2 kV<br>> 200 V<br>> 2 kV |
| Moisture Sensitivity, Indefinite Time Out of Drypack (Note 1)               | Pb-Free Pkg                 |
| LQFP-32<br>QFN-32                                                           | Level 2<br>Level 1          |
| Flammability Rating<br>Oxygen Index: 28 to 34                               | UL 94 V-0 @ 0.125 in        |
| Transistor Count                                                            | 919 Devices                 |
| 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 <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<br>NECL Mode Input Voltage | V <sub>EE</sub> = 0 V<br>V <sub>CC</sub> = 0 V | V <sub>I</sub> ≤ V <sub>CC</sub><br>V <sub>I</sub> ≥ V <sub>EE</sub> | 6<br>-6     | V<br>V       |
| I <sub>out</sub> | Output Current                                     | Continuous<br>Surge                            |                                                                      | 50<br>100   | mA<br>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<br>500 lfpm                             | LQFP-32<br>LQFP-32                                                   | 80<br>55    | °C/W<br>°C/W |
| θ <sub>JC</sub>  | Thermal Resistance (Junction-to-Case)              | Standard Board                                 | LQFP-32                                                              | 12 to 17    | °C/W         |
| θ <sub>JA</sub>  | Thermal Resistance (Junction-to-Ambient)           | 0 lfpm<br>500 lfpm                             | QFN-32<br>QFN-32                                                     | 31<br>27    | °C/W<br>°C/W |
| θ <sub>JC</sub>  | Thermal Resistance (Junction-to-Case)              | 2S2P                                           | QFN-32                                                               | 12          | °C/W         |
| T <sub>sol</sub> | Wave Solder<br>Pb-Free                             |                                                |                                                                      | 265         | °C           |

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.

# MC10EP451, MC100EP451

**Table 4. 10EP 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                                                       | 80    | 95   | 125  | 80   | 95   | 125  | 80   | 95   | 125  | mA            |
| $V_{OH}$    | Output HIGH Voltage (Note 3)                                               | 2165  | 2290 | 2415 | 2230 | 2355 | 2480 | 2290 | 2415 | 2540 | mV            |
| $V_{OL}$    | Output LOW Voltage (Note 3)                                                | 1365  | 1490 | 1615 | 1430 | 1555 | 1680 | 1470 | 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            |
| $V_{IHCMR}$ | 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  |      |      | $\mu\text{A}$ |

**Table 5. 10EP 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                                                       | 80    | 95   | 125  | 80   | 95   | 125  | 80   | 95   | 125  | mA            |
| $V_{OH}$    | Output HIGH Voltage (Note 3)                                               | 3865  | 3990 | 4115 | 3930 | 4055 | 4180 | 3990 | 4115 | 4240 | mV            |
| $V_{OL}$    | Output LOW Voltage (Note 3)                                                | 3065  | 3190 | 3315 | 3130 | 3255 | 3380 | 3170 | 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            |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 4) | 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  |      |      | $\mu\text{A}$ |

**Table 6. 10EP DC CHARACTERISTICS, NECL**  $V_{CC} = 0\text{ V}$ ,  $V_{EE} = -5.5\text{ V}$  to  $-3.0\text{ V}$  (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                                                       | 80           | 95    | 125   | 80           | 95    | 125   | 80           | 95    | 125   | mA            |
| $V_{OH}$    | Output HIGH Voltage (Note 3)                                               | -1135        | -1010 | -885  | -1070        | -945  | -820  | -1010        | -885  | -760  | mV            |
| $V_{OL}$    | Output LOW Voltage (Note 3)                                                | -1935        | -1810 | -1685 | -1870        | -1745 | -1620 | -1830        | -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            |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 4) | $V_{EE}+2.0$ |       | 0.0   | $V_{EE}+2.0$ |       | 0.0   | $V_{EE}+2.0$ |       | 0.0   | V             |
| $I_{IH}$    | Input HIGH Current                                                         |              |       | 150   |              |       | 150   |              |       | 150   | $\mu\text{A}$ |
| $I_{IL}$    | 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.

- Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.3 V to -2.2 V.
- All loading with 50  $\Omega$  to  $V_{CC} - 2.0\text{ V}$ .
- $V_{IHCMR}$  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.
- Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +2.0 V to -0.5 V.
- Input and output parameters vary 1:1 with  $V_{CC}$ .

# MC10EP451, MC100EP451

**Table 7. 100EP DC CHARACTERISTICS, PECL**  $V_{CC} = 3.3\text{ V}$ ,  $V_{EE} = 0\text{ V}$  (Note 7)

| Symbol      | Characteristic                                                             | -40°C |      |      | 25°C |      |      | 85°C |      |      | Unit          |
|-------------|----------------------------------------------------------------------------|-------|------|------|------|------|------|------|------|------|---------------|
|             |                                                                            | Min   | Typ  | Max  | Min  | Typ  | Max  | Min  | Typ  | Max  |               |
| $I_{EE}$    | Power Supply Current                                                       | 85    | 105  | 135  | 85   | 105  | 135  | 85   | 105  | 135  | mA            |
| $V_{OH}$    | Output HIGH Voltage (Note 8)                                               | 2155  | 2280 | 2405 | 2155 | 2280 | 2405 | 2155 | 2280 | 2405 | mV            |
| $V_{OL}$    | Output LOW Voltage (Note 8)                                                | 1305  | 1480 | 1605 | 1305 | 1480 | 1605 | 1305 | 1480 | 1605 | mV            |
| $V_{IH}$    | Input HIGH Voltage (Single-Ended)                                          | 2075  |      | 2420 | 2075 |      | 2420 | 2075 |      | 2420 | mV            |
| $V_{IL}$    | Input LOW Voltage (Single-Ended)                                           | 1305  |      | 1675 | 1305 |      | 1675 | 1305 |      | 1675 | mV            |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 9) | 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 lfm.

7. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.3 V to -2.2 V.

8. All loading with 50  $\Omega$  to  $V_{CC} - 2.0\text{ V}$ .

9.  $V_{IHCMR}$  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.

**Table 8. 100EP DC CHARACTERISTICS, PECL**  $V_{CC} = 5.0\text{ V}$ ,  $V_{EE} = 0\text{ V}$  (Note 10)

| Symbol      | Characteristic                                                              | -40°C |      |      | 25°C |      |      | 85°C |      |      | Unit          |
|-------------|-----------------------------------------------------------------------------|-------|------|------|------|------|------|------|------|------|---------------|
|             |                                                                             | Min   | Typ  | Max  | Min  | Typ  | Max  | Min  | Typ  | Max  |               |
| $I_{EE}$    | Power Supply Current                                                        | 85    | 105  | 135  | 85   | 105  | 135  | 85   | 105  | 135  | mA            |
| $V_{OH}$    | Output HIGH Voltage (Note 11)                                               | 3855  | 3980 | 4105 | 3855 | 3980 | 4105 | 3855 | 3980 | 4105 | mV            |
| $V_{OL}$    | Output LOW Voltage (Note 11)                                                | 3005  | 3180 | 3305 | 3005 | 3180 | 3305 | 3005 | 3180 | 3305 | mV            |
| $V_{IH}$    | Input HIGH Voltage (Single-Ended)                                           | 3775  |      | 4120 | 3775 |      | 4120 | 3775 |      | 4120 | mV            |
| $V_{IL}$    | Input LOW Voltage (Single-Ended)                                            | 3005  |      | 3375 | 3005 |      | 3375 | 3005 |      | 3375 | mV            |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 12) | 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 lfm.

10. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +2.0 V to -0.5 V.

11. All loading with 50  $\Omega$  to  $V_{CC} - 2.0\text{ V}$ .

12.  $V_{IHCMR}$  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.

# MC10EP451, MC100EP451

**Table 9. 100EP DC CHARACTERISTICS, NECL**  $V_{CC} = 0\text{ V}$ ,  $V_{EE} = -5.5\text{ V}$  to  $-3.0\text{ V}$  (Note 13)

| Symbol      | Characteristic                                                              | -40°C        |       |       | 25°C         |       |       | 85°C         |       |       | Unit          |
|-------------|-----------------------------------------------------------------------------|--------------|-------|-------|--------------|-------|-------|--------------|-------|-------|---------------|
|             |                                                                             | Min          | Typ   | Max   | Min          | Typ   | Max   | Min          | Typ   | Max   |               |
| $I_{EE}$    | Power Supply Current                                                        | 85           | 105   | 135   | 85           | 105   | 135   | 85           | 105   | 135   | mA            |
| $V_{OH}$    | Output HIGH Voltage (Note 14)                                               | -1145        | -1020 | -895  | -1145        | -1020 | -895  | -1145        | -1020 | -895  | mV            |
| $V_{OL}$    | Output LOW Voltage (Note 14)                                                | -1995        | -1820 | -1695 | -1995        | -1820 | -1695 | -1995        | -1820 | -1695 | mV            |
| $V_{IH}$    | Input HIGH Voltage (Single-Ended)                                           | -1225        |       | -880  | -1225        |       | -880  | -1225        |       | -880  | mV            |
| $V_{IL}$    | Input LOW Voltage (Single-Ended)                                            | -1995        |       | -1625 | -1995        |       | -1625 | -1995        |       | -1625 | mV            |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 15) | $V_{EE}+2.0$ |       | 0.0   | $V_{EE}+2.0$ |       | 0.0   | $V_{EE}+2.0$ |       | 0.0   | V             |
| $I_{IH}$    | Input HIGH Current                                                          |              |       | 150   |              |       | 150   |              |       | 150   | $\mu\text{A}$ |
| $I_{IL}$    | 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.

13. Input and output parameters vary 1:1 with  $V_{CC}$ .

14. All loading with  $50\ \Omega$  to  $V_{CC} - 2.0\text{ V}$ .

15.  $V_{IHCMR}$  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.

**Table 10. AC CHARACTERISTICS**  $V_{CC} = 0\text{ V}$ ;  $V_{EE} = -3.0\text{ V}$  to  $-5.5\text{ V}$  or  $V_{CC} = 3.0\text{ V}$  to  $5.5\text{ V}$ ;  $V_{EE} = 0\text{ V}$  (Note 16)

| Symbol                   | Characteristic                                                  | -40°C      |            |            | 25°C       |            |            | 85°C       |            |            | Unit |
|--------------------------|-----------------------------------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------|
|                          |                                                                 | Min        | Typ        | Max        | Min        | Typ        | Max        | Min        | Typ        | Max        |      |
| $V_{OUTpp}$              | Output Voltage Amplitude @ 3 GHz (Figure 4) (Note 17)           | 540        | 670        |            | 520        | 650        |            | 450        | 580        |            | mV   |
| $t_{PLH}$ ,<br>$t_{PHL}$ | Propagation Delay to CLK to Q, $\bar{Q}$ MR to Q, $\bar{Q}$     | 330<br>430 | 430<br>530 | 530<br>630 | 350<br>450 | 450<br>550 | 550<br>650 | 390<br>490 | 490<br>590 | 590<br>690 | ps   |
| $t_{RR}$                 | Reset Recovery MR to CLK                                        | 240        | 145        |            | 250        | 150        |            | 260        | 160        |            | ps   |
| $t_S$ ,<br>$t_H$         | Setup Time D to CLK<br>Hold Time CLK to D                       | 80<br>80   | 40<br>40   |            | 80<br>80   | 40<br>40   |            | 80<br>80   | 40<br>40   |            | ps   |
| $t_{PW}$                 | Minimum Pulse Rate MR                                           | 400        |            |            | 400        |            |            | 400        |            |            | ps   |
| $t_{SKEW}$               | Within-Device Skew (Note 18)<br>Device-To-Device Skew (Note 19) |            | 20<br>35   | 40<br>100  |            | 20<br>35   | 40<br>100  |            | 20<br>35   | 40<br>100  |      |
| $t_{JITTER}$             | CLOCK Random Jitter (RMS) @ $\leq 3.0\text{ GHz}$ (Figure 4)    |            | 0.2        | 1          |            | 0.2        | 1          |            | 0.2        | 1          | ps   |
| $t_r$ ,<br>$t_f$         | Output Rise/Fall Times (20% – 80%) Q, $\bar{Q}$                 | 100<br>100 | 150<br>150 | 250<br>250 | 110<br>110 | 160<br>160 | 260<br>260 | 130<br>130 | 180<br>180 | 280<br>280 | 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 lfm.

16. Measured using a 750 mV source, 50% duty cycle clock source. All loading with  $50\ \Omega$  to  $V_{CC} - 2.0\text{ V}$ .

17.  $V_{OL}$  and  $V_{OH}$  specifications not guaranteed for  $F_{max}$  testing.

18. Skew is measured between outputs under identical transitions and conditions on any one device.

19. Device-To-Device skew for identical transitions at identical  $V_{CC}$  levels.

## MC10EP451, MC100EP451

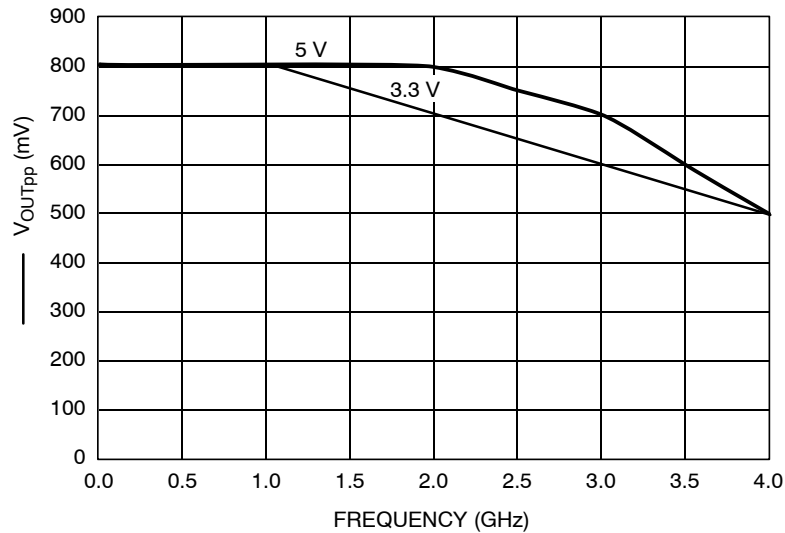


Figure 4. F<sub>max</sub> Typical

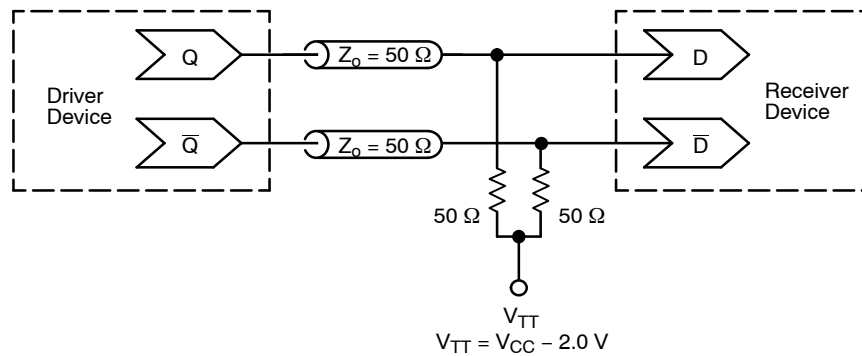
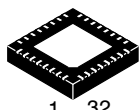


Figure 5. Typical Termination for Output Driver and Device Evaluation  
(See Application Note [AND8020/D](#) – Termination of ECL Logic Devices.)

### 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

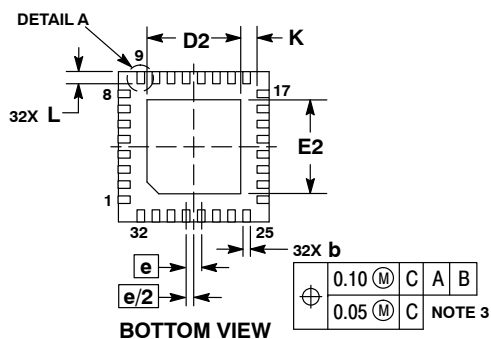
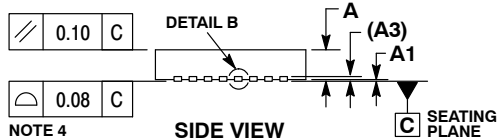
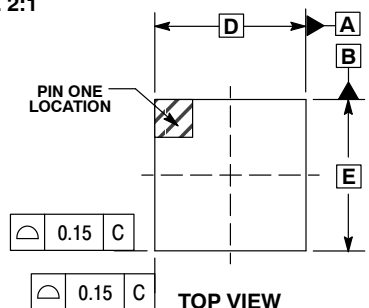
ECLinPS is registered trademark of Semiconductor Components Industries, LLC dba “onsemi” or its affiliates and/or subsidiaries in the United States and/or other countries.



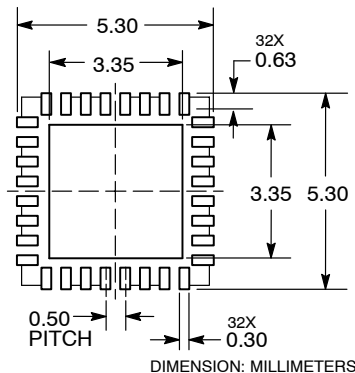
1 32  
SCALE 2:1

**QFN32 5x5, 0.5P**  
**CASE 488AM**  
**ISSUE A**

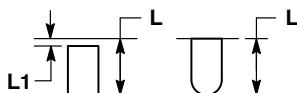
DATE 23 OCT 2013



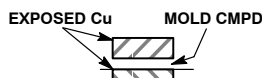
**RECOMMENDED  
SOLDERING FOOTPRINT\***



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



**DETAIL A**  
**ALTERNATE TERMINAL**  
**CONSTRUCTIONS**



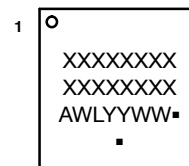
**DETAIL B**  
**ALTERNATE**  
**CONSTRUCTION**

**NOTES:**

1. DIMENSIONS 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 0.30MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| MILLIMETERS |          |      |
|-------------|----------|------|
| DIM         | MIN      | MAX  |
| A           | 0.80     | 1.00 |
| A1          |          | 0.05 |
| A3          | 0.20 REF |      |
| b           | 0.18     | 0.30 |
| D           | 5.00 BSC |      |
| D2          | 2.95     | 3.25 |
| E           | 5.00 BSC |      |
| E2          | 2.95     | 3.25 |
| e           | 0.50 BSC |      |
| K           | 0.20     |      |
| L           | 0.30     | 0.50 |
| L1          |          | 0.15 |

**GENERIC  
MARKING DIAGRAM\***



XXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

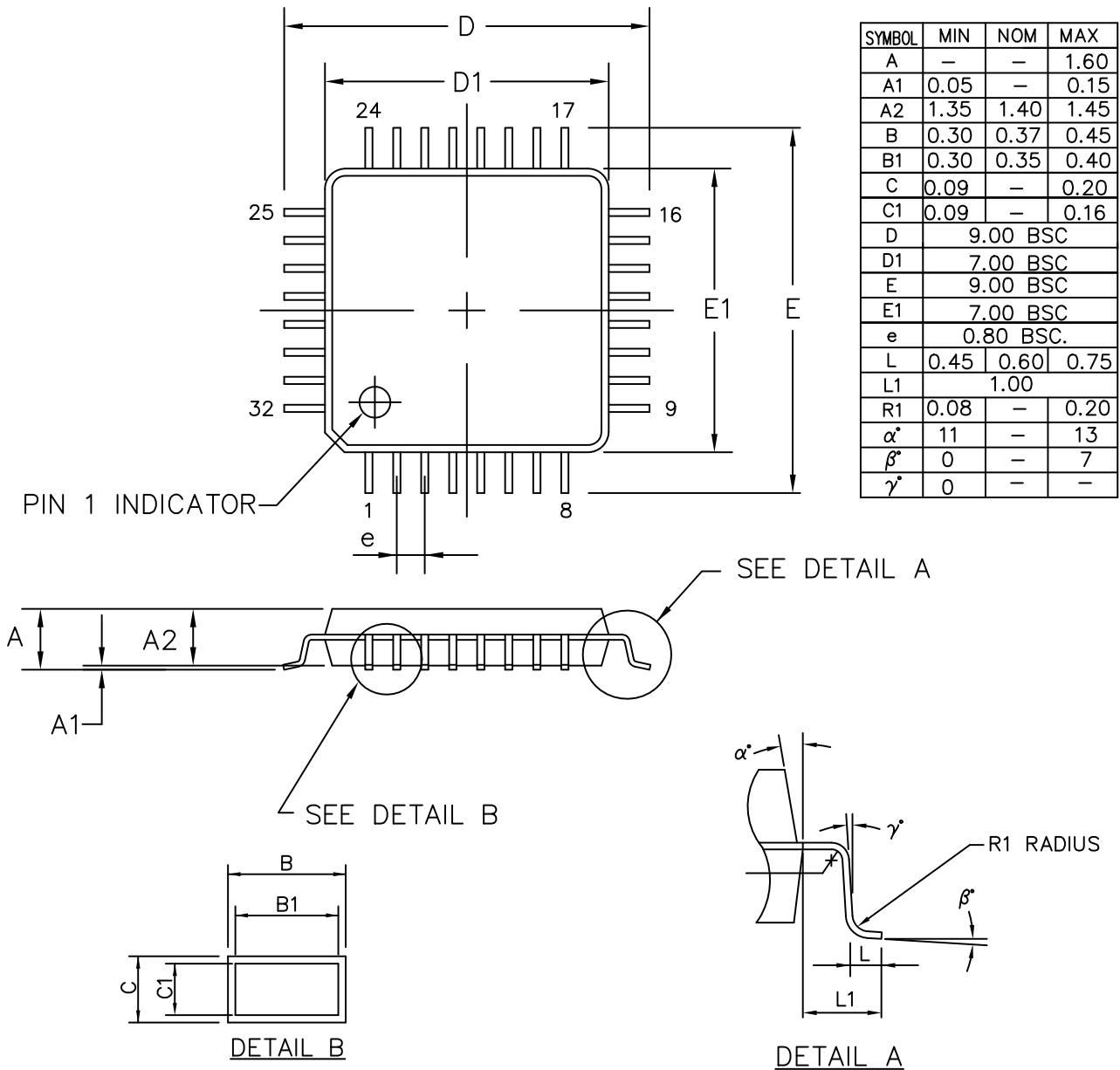
\*This information is generic. Please refer to device data sheet for actual part marking.  
Pb-Free indicator, "G" or microdot "▪", may or may not be present.

|                         |                       |                                                                                                                                                                                  |
|-------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>DOCUMENT NUMBER:</b> | <b>98AON20032D</b>    | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| <b>DESCRIPTION:</b>     | <b>QFN32 5x5 0.5P</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                               |

onsemi and Onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

**LQFP-32, 7x7**  
CASE 561AB  
ISSUE O

DATE 19 JUN 2008



ALL DIMENSIONS IN MM

|                         |                          |                                                                                                                                                                                     |
|-------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>DOCUMENT NUMBER:</b> | <b>98AON30893E</b>       | Electronic versions are uncontrolled except when accessed directly from the Document Repository.<br>Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| <b>DESCRIPTION:</b>     | <b>32 LEAD LQFP, 7X7</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                                  |

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)

