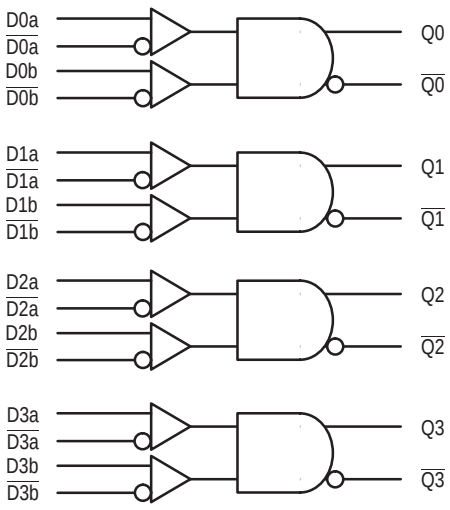
# MC10EP105

# Quad 2-Input Differential AND/NAND

The MC10EP105 is a quad 2–input differential AND/NAND gate. Each gate is functionally equivalent to the EP05 and LVEL05 devices. With AC performance much faster than the LVEL05 device, the EP105 is ideal for applications requiring the fastest AC performance available. All $V_{CC}$ and $V_{EE}$ pins must be externally connected to power supply to guarantee proper operation.

- 275ps Typical Propagation Delay
- High Bandwidth to 3 Ghz Typical
- ECL mode: 0V $V_{CC}$ with $V_{EE}$ = –3.0V to –5.5V
- PECL mode: 3.0V to 5.5V $V_{CC}$ with $V_{EE}$ = 0V
- Internal Input Pulldown Resistors
- ESD Protection: >4KV HBM, >100V MM
- New Differential Input Common Mode Range
- Moisture Sensitivity Level 2
  For Additional Information, See Application Note AND8003/D
- Flammability Rating: UL–94 code V–0 @ 1/8”,
  Oxygen Index 28 to 34
- Transistor Count = 444 devices

**LOGIC DIAGRAM**

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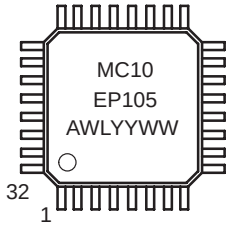
**32–LEAD TQFP**
**FA SUFFIX**
**CASE 873A**

**MARKING DIAGRAM***




A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week

*For additional information, see Application Note AND8002/D

| PIN DESCRIPTION | |
|---|---|
| **PIN** | **FUNCTION** |
| Dna, Dnb, $\overline{\text{Dna}}$, $\overline{\text{Dnb}}$ | ECL Data Inputs |
| Qn, $\overline{\text{Qn}}$ | ECL Data Outputs |
| VBB | Reference Voltage Output |
| VCC | Positive Supply |
| VEE | Negative, 0 Supply |

**TRUTH TABLE**

| Dna | Dnb | $\overline{\text{Dna}}$ | $\overline{\text{Dnb}}$ | Qn | $\overline{\text{Qn}}$ |
|---|---|---|---|---|---|
| L | L | H | H | L | H |
| L | H | H | L | L | H |
| H | L | L | H | L | H |
| H | H | L | L | H | L |

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MC10EP105FA | TQFP | 250 Units/Tray |
| MC10EP105FAR2 | TQFP | 2000 Tape & Reel |

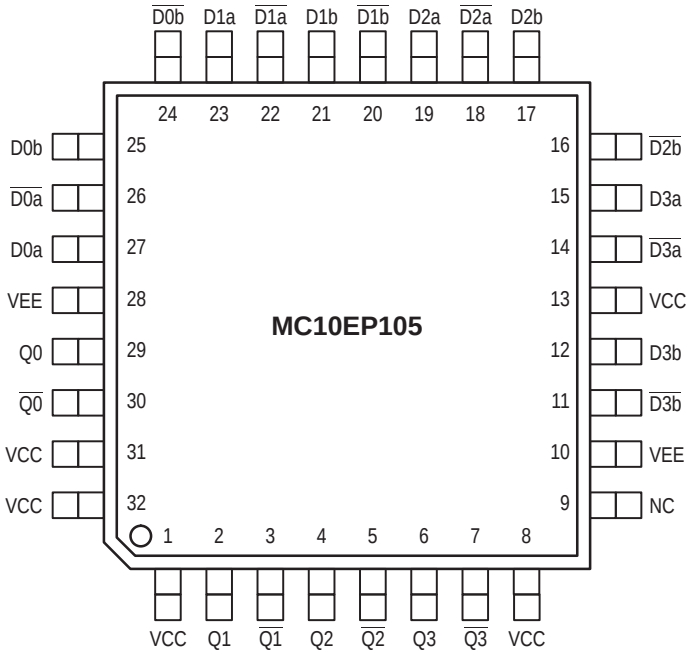



**Figure 1. 32–Lead TQFP Pinout**
(Top View)

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

**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 |
| $T_A$ | 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 | 80<br>55 | °C/W |
| $\theta_{JC}$ | Thermal Resistance (Junction–to–Case) | 12 to 17 | °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.

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

| Symbol | Characteristic | –40°C | | | 25°C | | | 85°C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| IEE | Power Supply Current (Note 1.) | 45 | 58 | 75 | 45 | 59 | 75 | 45 | 60 | 75 | 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.) | –1995 | –1810 | –1685 | –1995 | –1745 | –1620 | –1995 | –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 (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 D<br>$\overline{D}$ | 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.)

| Symbol | Characteristic | –40°C | | | 25°C | | | 85°C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| IEE | Power Supply Current (Note 5.) | 45 | 58 | 75 | 45 | 59 | 75 | 45 | 60 | 75 | 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.) | 1305 | 1490 | 1615 | 1305 | 1555 | 1680 | 1305 | 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 (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 D<br>$\overline{D}$ | 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.)

| Symbol | Characteristic | –40°C | | | 25°C | | | 85°C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| IEE | Power Supply Current (Note 9.) | 45 | 58 | 75 | 45 | 59 | 75 | 45 | 60 | 75 | 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.) | 3005 | 3190 | 3315 | 3005 | 3255 | 3380 | 3005 | 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 (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 D<br>$\overline{D}$ | 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 $V_{CC}$.

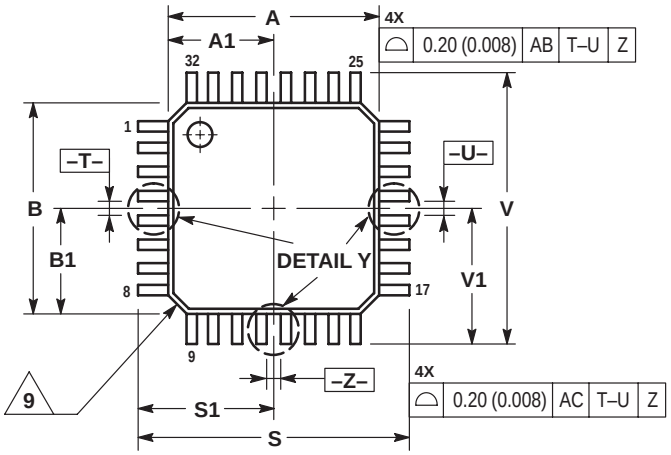
**AC CHARACTERISTICS** ($V_{CC}$ = 0V; $V_{EE}$ = –3.0V to –5.5V) or ($V_{CC}$ = 3.0V to 5.5V; $V_{EE}$ = 0V)

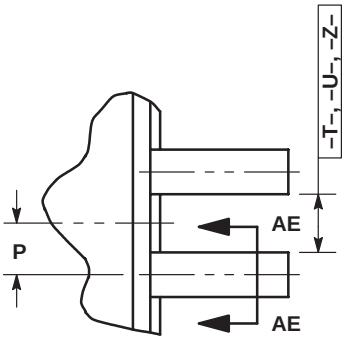
| Symbol | Characteristic | –40°C | | | 25°C | | | 85°C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| $f_{max}$ | Maximum Toggle Frequency (Note 13.) | | 3.0 | | | 3.0 | | | 3.0 | | GHz |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay to Output Differential | 150 | 250 | 350 | 175 | 275 | 375 | 200 | 300 | 400 | ps |
| $t_{SKEW}$ | Duty Cycle Skew (Note 14.) | | 5.0 | | | 5.0 | 20 | | 5.0 | 20 | 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 Q (20% – 80%) | 100 | 150 | 200 | 120 | 170 | 220 | 150 | 200 | 250 | 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.

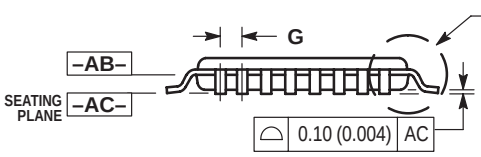
## PACKAGE DIMENSIONS

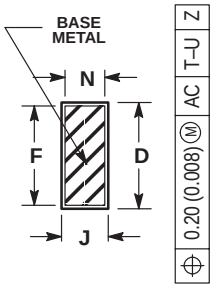
**TQFP**
**FA SUFFIX**
32–LEAD PLASTIC PACKAGE
CASE 873A–02
ISSUE A



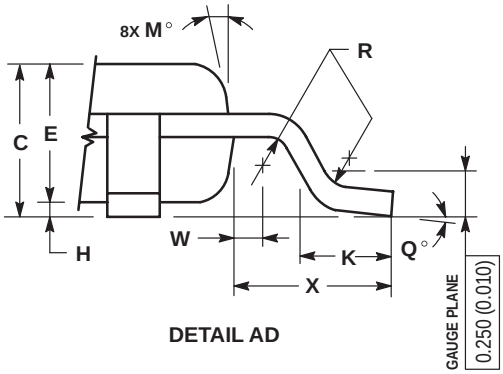




**DETAIL Y**




**SECTION AE–AE**




**DETAIL AD**

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DATUM PLANE –AB– IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
4. DATUMS –T–, –U–, AND –Z– TO BE DETERMINED AT DATUM PLANE –AB–.
5. DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE –AC–.
6. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.250 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE –AB–.
7. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED 0.520 (0.020).
8. MINIMUM SOLDER PLATE THICKNESS SHALL BE 0.0076 (0.0003).
9. EXACT SHAPE OF EACH CORNER MAY VARY FROM DEPICTION.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 7.000 BSC | | 0.276 BSC | |
| A1 | 3.500 BSC | | 0.138 BSC | |
| B | 7.000 BSC | | 0.276 BSC | |
| B1 | 3.500 BSC | | 0.138 BSC | |
| C | 1.400 | 1.600 | 0.055 | 0.063 |
| D | 0.300 | 0.450 | 0.012 | 0.018 |
| E | 1.350 | 1.450 | 0.053 | 0.057 |
| F | 0.300 | 0.400 | 0.012 | 0.016 |
| G | 0.800 BSC | | 0.031 BSC | |
| H | 0.050 | 0.150 | 0.002 | 0.006 |
| J | 0.090 | 0.200 | 0.004 | 0.008 |
| K | 0.500 | 0.700 | 0.020 | 0.028 |
| M | 12° REF | | 12° REF | |
| N | 0.090 | 0.160 | 0.004 | 0.006 |
| P | 0.400 BSC | | 0.016 BSC | |
| Q | 1° | 5° | 1° | 5° |
| R | 0.150 | 0.250 | 0.006 | 0.010 |
| S | 9.000 BSC | | 0.354 BSC | |
| S1 | 4.500 BSC | | 0.177 BSC | |
| V | 9.000 BSC | | 0.354 BSC | |
| V1 | 4.500 BSC | | 0.177 BSC | |
| W | 0.200 REF | | 0.008 REF | |
| X | 1.000 REF | | 0.039 REF | |

# Notes

# Notes

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