



**THE DATASHEET OF
MC100E104FNR2G**



MC10E104, MC100E104

5 V ECL Quint 2-Input AND/NAND Gate

Description

The MC10E/100E104 is a quint 2-input AND/NAND gate. The function output F is the OR of all five AND gate outputs, while \bar{F} is the NOR. The Q outputs need not be terminated if only the F outputs are to be used.

The 100 Series contains temperature compensation.

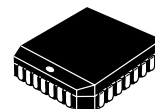
Features

- 600 ps Max. Propagation Delay
- OR/NOR Function Outputs
- PECL Mode Operating Range: $V_{CC} = 4.2\text{ V}$ to 5.7 V with $V_{EE} = 0\text{ V}$
- NECL Mode Operating Range: $V_{CC} = 0\text{ V}$ with $V_{EE} = -4.2\text{ V}$ to -5.7 V
- Internal Input $50\text{ k}\Omega$ Pulldown Resistors
- ESD Protection:
 - ◆ $> 2\text{ kV}$ Human Body Model
 - ◆ $> 200\text{ V}$ Machine Model
- Meets or Exceeds JEDEC Spec EIA/JESD78 IC Latchup Test
- Moisture Sensitivity: Level 3 (Pb-Free)
(For Additional Information, see Application Note [AND8003/D](#))
- Flammability Rating: UL 94 V-0 @ 0.125 in, Oxygen Index: 28 to 34
- Transistor Count = 134 Devices
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant



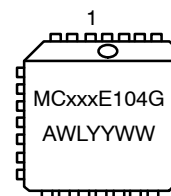
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PLCC-28
FN SUFFIX
CASE 776-02

MARKING DIAGRAM*



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

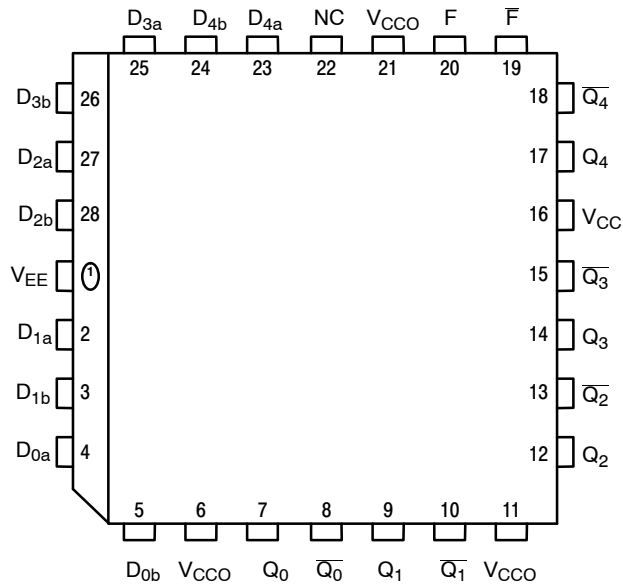
*For additional marking information, refer to Application Note [AND8002/D](#).

ORDERING INFORMATION

Device	Package	Shipping†
MC10E104FNG	PLCC-28 (Pb-Free)	37 Units / Tube
MC10E104FNR2G	PLCC-28 (Pb-Free)	500 Tape & Reel
MC100E104FNR2G	PLCC-28 (Pb-Free)	500 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](#).

MC10E104, MC100E104



D_{0b} V_{CCO} Q₀ $\overline{Q_0}$ Q₁ $\overline{Q_1}$ V_{CCO}
 All V_{CC} and V_{CCO} pins are tied together on the die.
 Warning: All V_{CC}, V_{CCO}, and V_{EE} pins must be externally connected to Power Supply to guarantee proper operation.

Figure 1. 28-Lead Pinout (Top View)

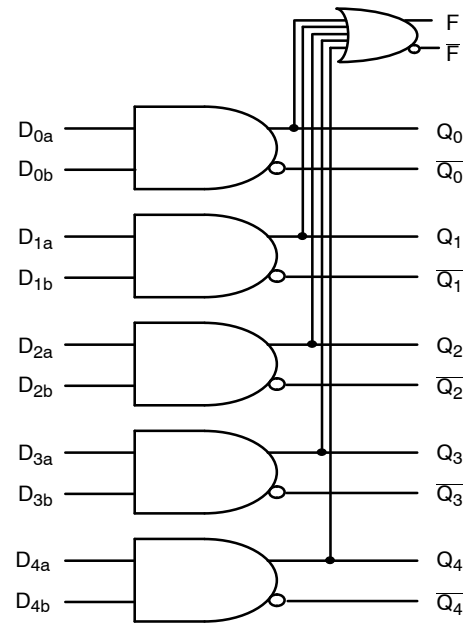


Figure 2. Logic Diagram

Table 1. PIN DESCRIPTION

PIN	FUNCTION
D _{0a} - D _{4b}	ECL Data Inputs
Q ₀ - Q ₄	ECL AND Outputs
$\overline{Q_0}$ - $\overline{Q_4}$	ECL NAND Outputs
F	ECL OR Output
\overline{F}	ECL NOR Output
V _{CC} , V _{CCO}	Positive Supply
V _{EE}	Negative Supply
NC	No Connect

Table 2. FUNCTION OUTPUTS

F =	$(D_{0a} \cdot D_{0b}) + (D_{1a} \cdot D_{1b}) + (D_{2a} \cdot D_{2b}) + (D_{3a} \cdot D_{3b}) + (D_{4a} \cdot D_{4b})$
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MC10E104, MC100E104

Table 3. MAXIMUM RATINGS

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V _{CC}	PECL Mode Power Supply	V _{EE} = 0 V		8	V
V _{EE}	NECL Mode Power Supply	V _{CC} = 0 V		-6	V
V _I	PECL Mode Input Voltage NECL Mode Input Voltage	V _{EE} = 0 V V _{CC} = 0 V	V _I ≤ V _{CC} V _I ≥ V _{EE}	6 -6	V
I _{out}	Output Current	Continuous Surge		50 100	mA
T _A	Operating Temperature Range			0 to +85	°C
T _{stg}	Storage Temperature Range			-65 to +150	°C
θ _{JA}	Thermal Resistance (Junction-to-Ambient)	0 lfpm 500 lfpm	PLCC-28 PLCC-28	63.5 43.5	°C/W
θ _{JC}	Thermal Resistance (Junction-to-Case)	Standard Board	PLCC-28	22 to 26	°C/W
T _{sol}	Wave Solder (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.

Table 4. 10E SERIES PECL DC CHARACTERISTICS (V_{CC} = 5.0 V, V_{EE} = 0.0 V (Note 1))

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I _{EE}	Power Supply Current		38	46		38	46		38	46	mA
V _{OH}	Output HIGH Voltage (Note 2)	3980	4070	4160	4020	4105	4190	4090	4185	4280	mV
V _{OL}	Output LOW Voltage (Note 2)	3050	3210	3370	3050	3210	3370	3050	3227	3405	mV
V _{IH}	Input HIGH Voltage	3830	3995	4160	3870	4030	4190	3940	4110	4280	mV
V _{IL}	Input LOW Voltage	3050	3285	3520	3050	3285	3520	3050	3302	3555	mV
I _{IH}	Input HIGH Current			200			200			200	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.

1. Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary -0.46 V / +0.06 V.
2. Outputs are terminated through a 50 Ω resistor to V_{CC} - 2.0 V.

Table 5. 10E SERIES NECL DC CHARACTERISTICS (V_{CCx} = 0.0 V; V_{EE} = -5.0 V (Note 1))

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I _{EE}	Power Supply Current		38	46		38	46		38	46	mA
V _{OH}	Output HIGH Voltage (Note 2)	-1020	-930	-840	-980	-895	-810	-910	-815	-720	mV
V _{OL}	Output LOW Voltage (Note 2)	-1950	-1790	-1630	-1950	-1790	-1630	-1950	-1773	-1595	mV
V _{IH}	Input HIGH Voltage	-1170	-1005	-840	-1130	-970	-810	-1060	-890	-720	mV
V _{IL}	Input LOW Voltage	-1950	-1715	-1480	-1950	-1715	-1480	-1950	-1698	-1445	mV
I _{IH}	Input HIGH Current			200			200			200	μA
I _{IL}	Input LOW Current	0.5	0.3		0.5	0.065		0.3	0.2		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.

1. Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary -0.46 V / +0.06 V.
2. Outputs are terminated through a 50 Ω resistor to V_{CC} - 2.0 V.

MC10E104, MC100E104

Table 6. 100E SERIES PECL DC CHARACTERISTICS ($V_{CCx} = 5.0\text{ V}$; $V_{EE} = 0.0\text{ V}$ (Note 1))

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		38	46		38	46		44	53	mA
V_{OH}	Output HIGH Voltage (Note 2)	3975	4050	4120	3975	4050	4120	3975	4050	4120	mV
V_{OL}	Output LOW Voltage (Note 2)	3190	3295	3380	3190	3255	3380	3190	3260	3380	mV
V_{IH}	Input HIGH Voltage	3835	3975	4120	3835	3975	4120	3835	3975	4120	mV
V_{IL}	Input LOW Voltage	3190	3355	3525	3190	3525	3355	3190	3355	3525	mV
I_{IH}	Input HIGH Current			200			200			200	μA
I_{IL}	Input LOW Current	0.5	0.3		0.5	0.25		0.5	0.2		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.

1. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $-0.46\text{ V} / +0.8\text{ V}$.
2. Outputs are terminated through a $50\ \Omega$ resistor to $V_{CC} - 2.0\text{ V}$.

Table 7. 100E SERIES NECL DC CHARACTERISTICS ($V_{CCx} = 0\text{ V}$; $V_{EE} = -5.0\text{ V}$ (Note 1))

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		38	46		38	46		44	53	mA
V_{OH}	Output HIGH Voltage (Note 2)	-1025	-950	-880	-1025	-950	-880	-1025	-950	-880	mV
V_{OL}	Output LOW Voltage (Note 2)	-1810	-1705	-1620	-1810	-1745	-1620	-1810	-1740	-1620	mV
V_{IH}	Input HIGH Voltage	-1165	-1025	-880	-1165	-1025	-880	-1165	-1025	-880	mV
V_{IL}	Input LOW Voltage	-1810	-1645	-1475	-1810	-1645	-1475	-1810	-1645	-1475	mV
I_{IH}	Input HIGH Current			200			200			200	μA
I_{IL}	Input LOW Current	0.5	0.3		0.5	0.25		0.5	0.2		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.

1. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $-0.46\text{ V} / +0.8\text{ V}$.
2. Outputs are terminated through a $50\ \Omega$ resistor to $V_{CC} - 2.0\text{ V}$.

Table 8. AC CHARACTERISTICS ($V_{CCx} = 5.0\text{ V}$; $V_{EE} = 0.0\text{ V}$ or $V_{CCx} = 0.0\text{ V}$; $V_{EE} = -5.0\text{ V}$ (Note 1))

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
f_{MAX}	Maximum Toggle Frequency		700			700			700		MHz
t_{PLH} t_{PHL}	Propagation Delay to Output D to Q D to F	225 500	385 725	600 1000	225 500	385 725	600 1000	225 500	385 725	600 1000	ps
t_{SKEW}	Within-Device Skew (Note 2) D to Q		75			75			75		ps
t_{JITTER}	Random Clock Jitter (RMS)		< 1			< 1			< 1		ps
t_r t_f	Rise/Fall Time (20–80%) Q F	100 300	425 475	700 700	100 300	425 475	700 700	100 300	425 475	700 700	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.

1. 10 Series: V_{EE} can vary $-0.46\text{ V} / +0.06\text{ V}$.
100 Series: V_{EE} can vary $-0.46\text{ V} / +0.8\text{ V}$.
2. Within-device skew is defined as identical transitions on similar paths through a device.

MC10E104, MC100E104



Figure 3. Typical Termination for Output Driver and Device Evaluation
(See Application Note [AND8020/D](#) – Termination of ECL Logic Devices)

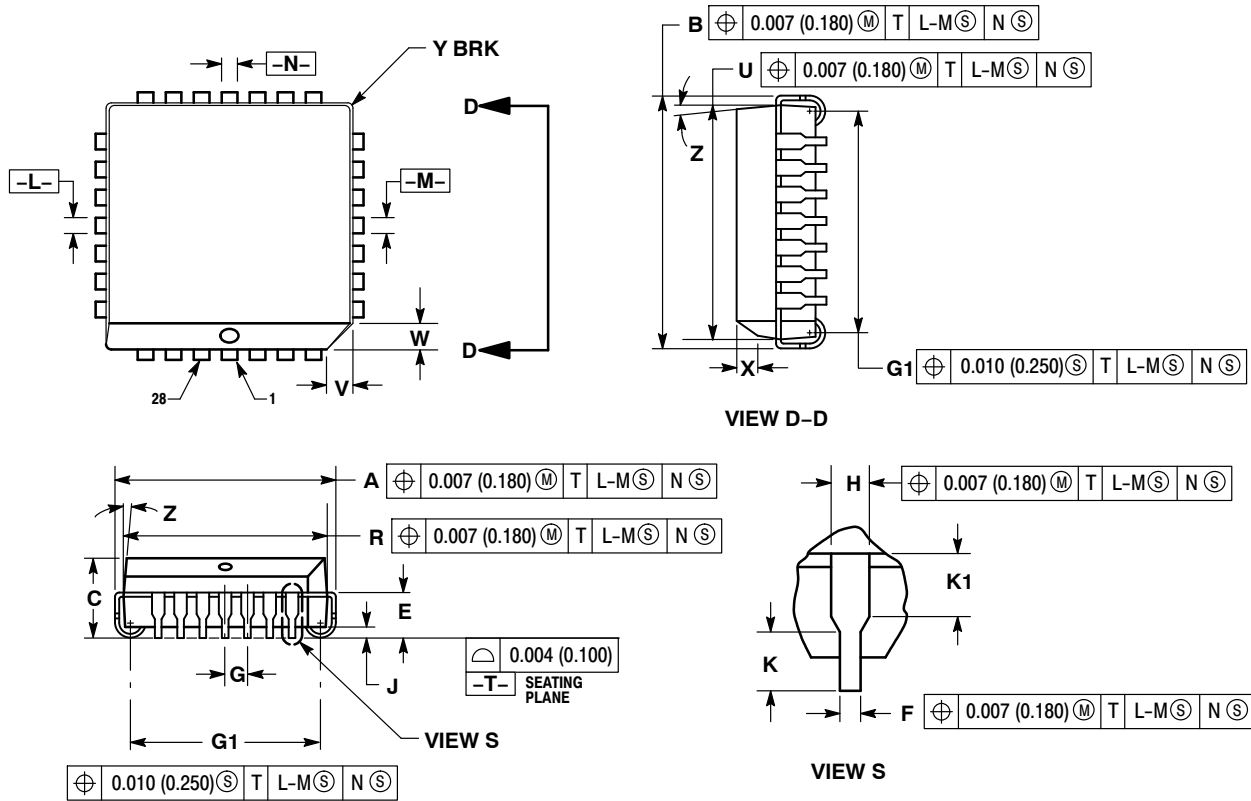
Resource Reference of Application Notes

- 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

MC10E104, MC100E104

PACKAGE DIMENSIONS

28 LEAD PLLC
FN SUFFIX
CASE 776-02
ISSUE F




NOTES:

- DATUMS $-L-$, $-M-$, AND $-N-$ DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
- DIMENSION $G1$, TRUE POSITION TO BE MEASURED AT DATUM $-T-$, SEATING PLANE.
- DIMENSIONS R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
- THE PACKAGE TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM BY UP TO 0.012 (0.300). DIMENSIONS R AND U ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
- DIMENSION H DOES NOT INCLUDE DAMBAR PROTRUSION OR INTRUSION. THE DAMBAR PROTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE GREATER THAN 0.037 (0.940). THE DAMBAR INTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE SMALLER THAN 0.025 (0.635).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.485	0.495	12.32	12.57
B	0.485	0.495	12.32	12.57
C	0.165	0.180	4.20	4.57
E	0.090	0.110	2.29	2.79
F	0.013	0.021	0.33	0.53
G	0.050 BSC		1.27 BSC	
H	0.026	0.032	0.66	0.81
J	0.020	---	0.51	---
K	0.025	---	0.64	---
R	0.450	0.456	11.43	11.58
U	0.450	0.456	11.43	11.58
V	0.042	0.048	1.07	1.21
W	0.042	0.048	1.07	1.21
X	0.042	0.056	1.07	1.42
Y	---	0.020	---	0.50
Z	2°	10°	2°	10°
G1	0.410	0.430	10.42	10.92
K1	0.040	---	1.02	---

MC10E104, MC100E104

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