

MC10E416, MC100E416

5V ECL Quint Differential Line Receiver

The MC10E416/100E416 is a 5-bit differential line receiving device. The 2.0 GHz of bandwidth provided by the high frequency outputs makes the device ideal for buffering of very high speed oscillators.

The design incorporates two stages of gain, internal to the device, making it an excellent choice for use in high bandwidth amplifier applications.

The differential inputs have internal clamp structures which will force the Q output of a gate in an open input condition to go to a LOW state. Thus, inputs of unused gates can be left open and will not affect the operation of the rest of the device. Note that the input clamp will take affect only if both inputs fall 2.5 V below V_{CC} .

The V_{BB} pin, an internally generated voltage supply, is available to this device only. For single-ended input conditions, the unused differential input is connected to V_{BB} as a switching reference voltage. V_{BB} may also rebias AC coupled inputs. When used, decouple V_{BB} and V_{CC} via a 0.01 μ F capacitor and limit current sourcing or sinking to 0.5 mA. When not used, V_{BB} should be left open.

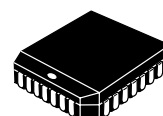
The 100 Series contains temperature compensation.

- Differential D and Q; V_{BB} available
- 600 ps Max. Propagation Delay
- High Frequency Outputs
- 2 Stages of Gain
- PECL Mode Operating Range: $V_{CC} = 4.2$ V to 5.7 V with $V_{EE} = 0$ V
- NECL Mode Operating Range: $V_{CC} = 0$ V with $V_{EE} = -4.2$ V to -5.7 V
- Internal Input 50 K Ω Pulldown Resistors
- ESD Protection: Human Body Model; > 2 KV, Machine Model; > 200 V
- Meets or Exceeds JEDEC Spec EIA/JESD78 IC Latchup Test
- Moisture Sensitivity Level 1
For Additional Information, see Application Note AND8003/D
- Flammability Rating: UL 94 V-0 @ 0.125 in, Oxygen Index: 28 to 34
- Transistor Count = 201 devices



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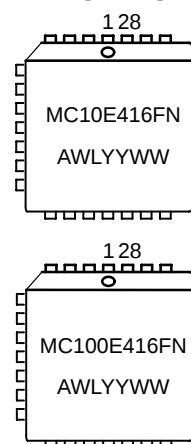
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PLCC-28
FN SUFFIX
CASE 776

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

MARKING DIAGRAMS



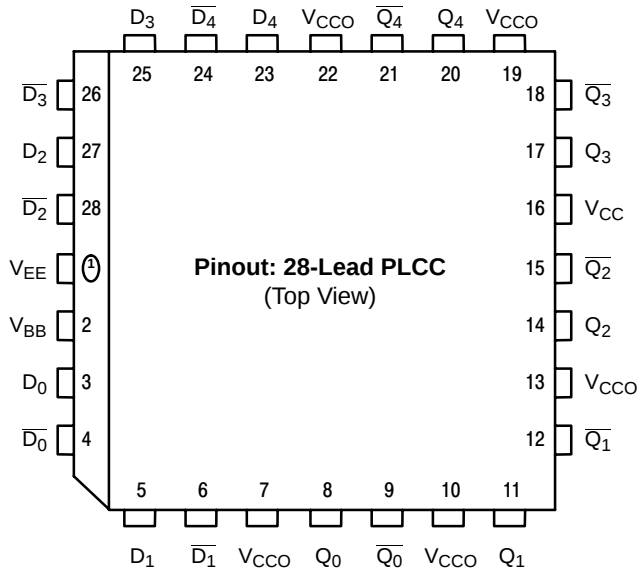
ORDERING INFORMATION

Device	Package	Shipping [†]
MC10E416FN	PLCC-28	37 Units/Rail
MC10E416FNR2	PLCC-28	500 Units/Reel
MC100E416FN	PLCC-28	37 Units/Rail
MC100E416FNR2	PLCC-28	500 Units/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.

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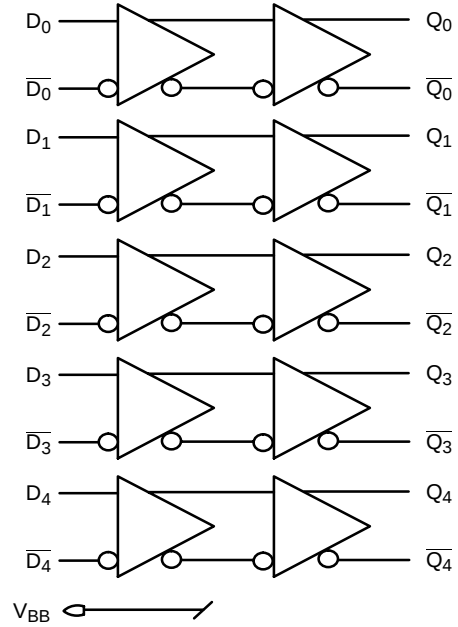
LOGIC DIAGRAM AND PINOUT ASSIGNMENT



*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.

LOGIC DIAGRAM



PIN DESCRIPTION

PIN	FUNCTION
D[0:4], $\overline{D}$ [0:4]	ECL Differential Data Inputs
Q[0:4], $\overline{Q}$ [0:4]	ECL Differential Data Outputs
V _{BB}	Reference Voltage Output
V _{CC} , V _{CCO}	Positive Supply
V _{EE}	Negative Supply

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MAXIMUM RATINGS (Note 1)

Symbol	Parameter	Condition 1	Condition 2	Rating	Units
V_{CC}	PECL Mode Power Supply	$V_{EE} = 0\text{ V}$		8	V
V_I	PECL Mode Input Voltage NECL Mode Input Voltage	$V_{EE} = 0\text{ V}$ $V_{CC} = 0\text{ V}$	$V_I \leq V_{CC}$ $V_I \geq V_{EE}$	6 -6	V V
I_{out}	Output Current	Continuous Surge		50 100	mA mA
I_{BB}	V_{BB} Sink/Source			± 0.5	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	28 PLCC 28 PLCC	63.5 43.5	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction-to-Case)	Standard Board	28 PLCC	22 to 26	°C/W
T_{sol}	Wave Solder	< 2 to 3 sec @ 248°C		265	°C

1. Maximum Ratings are those values beyond which device damage may occur.

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10E SERIES PECL DC CHARACTERISTICS $V_{CCx} = 5.0\text{ V}$; $V_{EE} = 0.0\text{ V}$ (Note 2)

Symbol	Characteristic	0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		135	162		135	162		135	162	mA
V_{OH}	Output HIGH Voltage (Note 3)	3980	4070	4160	4020	4105	4190	4090	4185	4280	mV
V_{OL}	Output LOW Voltage (Note 3)	3050	3210	3370	3050	3210	3370	3050	3227	3405	mV
V_{IH}	Input HIGH Voltage (Single-Ended)	3830	3995	4160	3870	4030	4190	3940	4110	4280	mV
V_{IL}	Input LOW Voltage (Single-Ended)	3050	3285	3520	3050	3285	3520	3050	3302	3555	mV
V_{BB}	Output Voltage Reference	3.62		3.73	3.65		3.75	3.69		3.81	V
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 4)	2.7		5.0	2.7		5.0	2.7		5.0	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	0.5	0.3		0.5	0.25		0.3	0.2		μA

NOTE: Devices 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 air flow greater than 500 lfm is maintained.

- Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $-0.46\text{ V} / +0.06\text{ V}$.
- Outputs are terminated through a $50\ \Omega$ resistor to $V_{CC}-2$ volts.
- V_{IHCMR} min varies 1:1 with V_{EE} , max varies 1:1 with V_{CC} .

10E SERIES NECL DC CHARACTERISTICS $V_{CCx} = 0.0\text{ V}$; $V_{EE} = -5.0\text{ V}$ (Note 5)

Symbol	Characteristic	0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		135	162		135	162		135	162	mA
V_{OH}	Output HIGH Voltage (Note 6)	-1020	-930	-840	-980	-895	-810	-910	-815	-720	mV
V_{OL}	Output LOW Voltage (Note 6)	-1950	-1790	-1630	-1950	-1790	-1630	-1950	-1773	-1595	mV
V_{IH}	Input HIGH Voltage (Single-Ended)	-1170	-1005	-840	-1130	-970	-810	-1060	-890	-720	mV
V_{IL}	Input LOW Voltage (Single-Ended)	-1950	-1715	-1480	-1950	-1715	-1480	-1950	-1698	-1445	mV
V_{BB}	Output Voltage Reference	-1.38		-1.27	-1.35		-1.25	-1.31		-1.19	V
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 7)	-2.3		0.0	-2.3		0.0	-2.3		0.0	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	0.5	0.3		0.5	0.065		0.3	0.2		μA

NOTE: Devices 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 air flow greater than 500 lfm is maintained.

- Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $-0.46\text{ V} / +0.06\text{ V}$.
- Outputs are terminated through a $50\ \Omega$ resistor to $V_{CC}-2$ volts.
- V_{IHCMR} min varies 1:1 with V_{EE} , max varies 1:1 with V_{CC} .

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100E SERIES PECL DC CHARACTERISTICS $V_{CCx}=5.0\text{ V}$; $V_{EE}=0.0\text{ V}$ (Note 8)

Symbol	Characteristic	0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		135	162		135	162		155	186	mA
V_{OH}	Output HIGH Voltage (Note 9)	3975	4050	4120	3975	4050	4120	3975	4050	4120	mV
V_{OL}	Output LOW Voltage (Note 9)	3190	3295	3380	3190	3255	3380	3190	3260	3380	mV
V_{IH}	Input HIGH Voltage (Single-Ended)	3835	3975	4120	3835	3975	4120	3835	3975	4120	mV
V_{IL}	Input LOW Voltage (Single-Ended)	3190	3355	3525	3190	3355	3525	3190	3355	3525	mV
V_{BB}	Output Voltage Reference	3.62		3.74	3.62		3.74	3.62		3.74	V
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 10)	2.7		5.0	2.7		5.0	2.7		5.0	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	0.5	0.3		0.5	0.25		0.5	0.2		μA

NOTE: Devices 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 air flow greater than 500 lfm is maintained.

8. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $-0.46\text{ V} / +0.8\text{ V}$.

9. Outputs are terminated through a $50\ \Omega$ resistor to $V_{CC}-2$ volts.

10. V_{IHCMR} min varies 1:1 with V_{EE} , max varies 1:1 with V_{CC} .

100E SERIES NECL DC CHARACTERISTICS $V_{CCx}=0.0\text{ V}$; $V_{EE}=-5.0\text{ V}$ (Note 11)

Symbol	Characteristic	0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		135	162		135	162		155	186	mA
V_{OH}	Output HIGH Voltage (Note 12)	-1025	-950	-880	-1025	-950	-880	-1025	-950	-880	mV
V_{OL}	Output LOW Voltage (Note 12)	-1810	-1705	-1620	-1810	-1745	-1620	-1810	-1740	-1620	mV
V_{IH}	Input HIGH Voltage (Single-Ended)	-1165	-1025	-880	-1165	-1025	-880	-1165	-1025	-880	mV
V_{IL}	Input LOW Voltage (Single-Ended)	-1810	-1645	-1475	-1810	-1645	-1475	-1810	-1645	-1475	mV
V_{BB}	Output Voltage Reference	-1.38		-1.26	-1.38		-1.26	-1.38		-1.26	V
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 13)	-2.3		0.0	-2.3		0.0	-2.3		0.0	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	0.5	0.3		0.5	0.25		0.5	0.2		μA

NOTE: Devices 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 air flow greater than 500 lfm is maintained.

11. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $-0.46\text{ V} / +0.8\text{ V}$.

12. Outputs are terminated through a $50\ \Omega$ resistor to $V_{CC}-2$ volts.

13. V_{IHCMR} min varies 1:1 with V_{EE} , max varies 1:1 with V_{CC} .

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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 14)

Symbol	Characteristic	0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
f_{MAX}	Maximum Toggle Frequency					> 2.0					GHz
t_{PLH} t_{PHL}	Propagation Delay to Output d(Diff) D(SE)	250 200	350 350	500 550	250 200	350 350	500 550	250 200	350 350	500 550	ps
t_{SKEW}	Within-Device Skew (Note 15)		50			50			50		ps
t_{SKEW}	Duty Cycle Skew (Note 16) $t_{\text{PLH}} - t_{\text{PHL}}$		± 10			± 10			± 10		ps
t_{JITTER}	Random Clock Jitter (RMS)		< 1			< 1			< 1		ps
$V_{\text{PP}}(\text{AC})$	Input Voltage Swing (Differential Configuration)	150		1000	150		1000	150		1000	mV
t_{r} t_{f}	Rise/Fall Time (20 - 80%)	100	200	350	100	200	350	100	200	350	ps

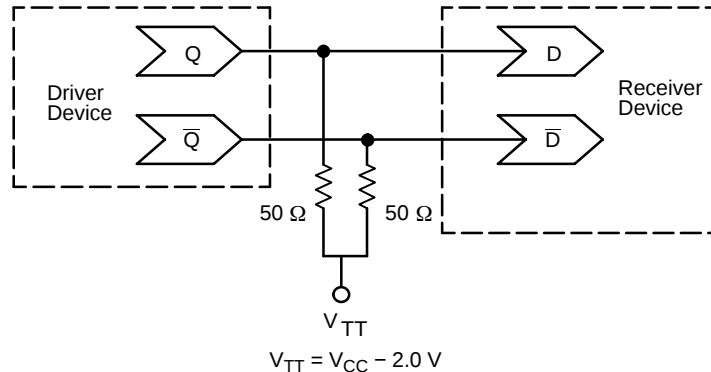
NOTE: Devices are designed to meet the AC specifications shown in the above table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 lfm is maintained.

14.10 Series: V_{EE} can vary $-0.46\text{ V} / +0.06\text{ V}$.

100 Series: V_{EE} can vary $-0.46\text{ V} / +0.8\text{ V}$.

15. Within-device skew is defined as identical transitions on similar paths through a device.

16. Duty cycle skew defined only for differential operation when the delays are measured from the cross point of the inputs to the cross point of the outputs.



**Figure 1. Typical Termination for Output Driver and Device Evaluation
(See Application Note AND8020 – Termination of ECL Logic Devices.)**

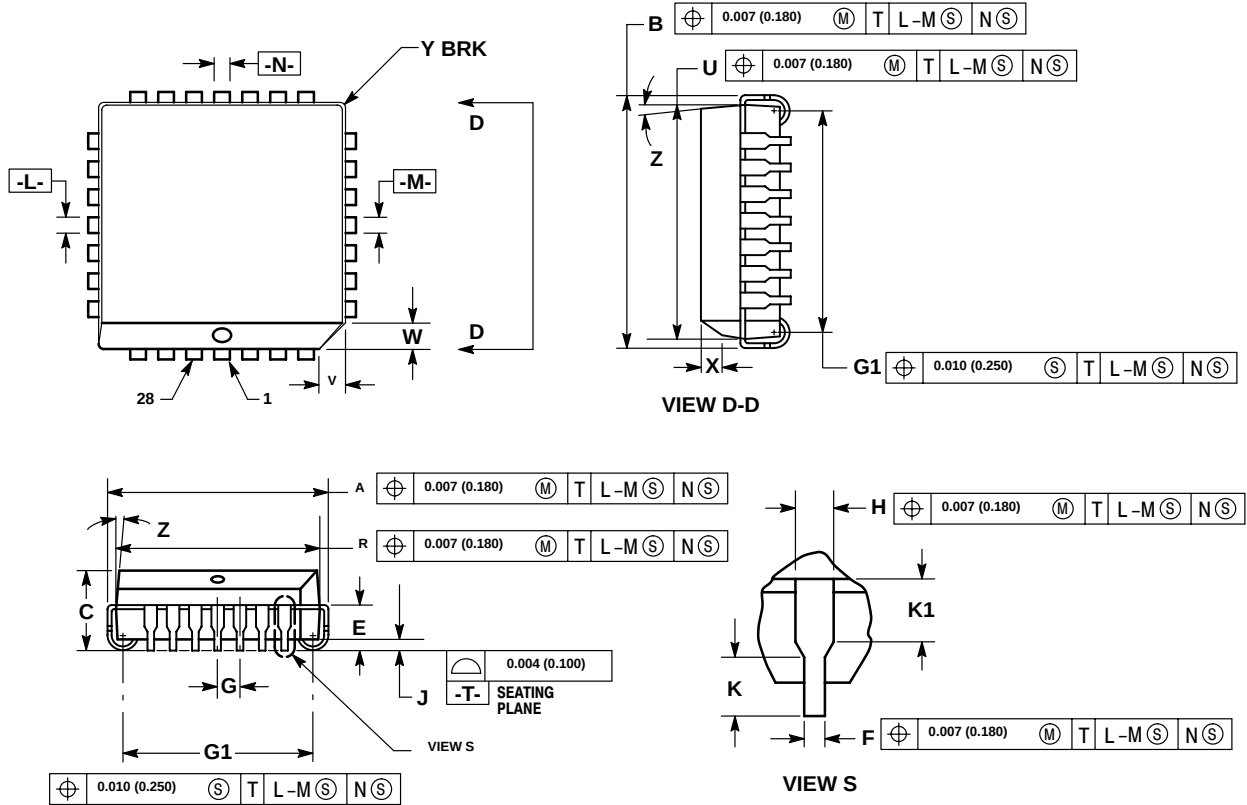
Resource Reference of Application Notes

- AN1404** – ECLinPS Circuit Performance at Non-Standard V_{IH} Levels
- AN1405** – ECL Clock Distribution Techniques
- AN1406** – Designing with PECL (ECL at +5.0 V)
- AN1503** – ECLinPS I/O SPICE Modeling Kit
- AN1504** – Metastability and the ECLinPS Family
- AN1568** – Interfacing Between LVDS and ECL
- AN1596** – ECLinPS Lite Translator ELT Family SPICE I/O Model Kit
- AN1650** – Using Wire-OR Ties in ECLinPS Designs
- AN1672** – The ECL Translator Guide
- AND8001** – Odd Number Counters Design
- AND8002** – Marking and Date Codes
- AND8020** – Termination of ECL Logic Devices

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PACKAGE DIMENSIONS

PLCC-28
FN SUFFIX
PLASTIC PLCC PACKAGE
CASE 776-02
ISSUE E



NOTES:

- DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
- DIM G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
- DIM 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	0.019	0.33	0.48
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	—

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