



**THE DATASHEET OF  
MC10E196FNR2**



# MC10E196, MC100E196

## 5V ECL Programmable Delay Chip

### Description

The MC10E/100E196 is a programmable delay chip (PDC) designed primarily for very accurate differential ECL input edge placement applications.

The delay section consists of a chain of gates and a linear ramp delay adjust organized as shown in the logic symbol. The first two delay elements feature gates that have been modified to have delays 1.25 and 1.5 times the basic gate delay of approximately 80 ps. These two elements provide the E196 with a digitally-selectable resolution of approximately 20 ps. The required device delay is selected by the seven address inputs D[0:6], which are latched on chip by a high signal on the latch enable (LEN) control.

The FTUNE input takes an analog voltage and applies it to an internal linear ramp for reducing the 20 ps Least Significant Bit (LSB) minimum resolution still further. The FTUNE input is what differentiates the E196 from the E195.

An eighth latched input, D7, is provided for cascading multiple PDC's for increased programmable range. The cascade logic allows full control of multiple PDC's, at the expense of only a single added line to the data bus for each additional PDC, without the need for any external gating.

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  $\mu$ 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.

### Features

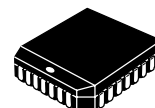
- 2.0 ns Worst Case Delay Range
- $\approx 20$  ps/Delay Step Resolution
- Linear Input for Tighter Resolution
- >1.0 GHz Bandwidth
- On Chip Cascade Circuitry
- PECL Mode Operating Range:  $V_{CC} = 4.2$  V to 5.7 V with  $V_{EE} = 0$  V
- NECL Mode Operating Range:  $V_{CC} = 0$  V with  $V_{EE} = -4.2$  V to -5.7 V
- Internal Input 50 k $\Omega$  Pulldown Resistors
- ESD Protection: Human Body Model; > 1 kV, Machine Model; > 75 V
- Meets or Exceeds JEDEC Spec EIA/JESD78 IC Latchup Test
- Moisture Sensitivity Level: Pb = 1; Pb-Free = 3 For Additional Information, see Application Note AND8003/D
- Flammability Rating: UL 94 V-0 @ 1.125 in, Oxygen Index: 28 to 34
- Transistor Count = 425 devices
- Pb-Free Packages are Available\*

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



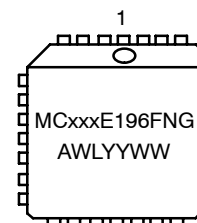
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PLCC-28  
FN SUFFIX  
CASE 776

### MARKING DIAGRAM\*



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

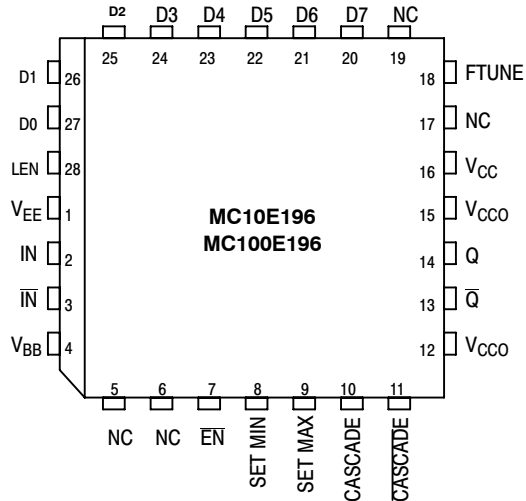
\*For additional marking information, refer to Application Note AND8002/D.

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 10 of this data sheet.

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## LOGIC DIAGRAM AND PINOUT ASSIGNMENT



\* All V<sub>CC</sub> and V<sub>CCO</sub> pins are tied together on the die.  
 Warning: All V<sub>CC</sub>, V<sub>CCO</sub>, and V<sub>EE</sub> pins must be externally connected to Power Supply to guarantee proper operation.

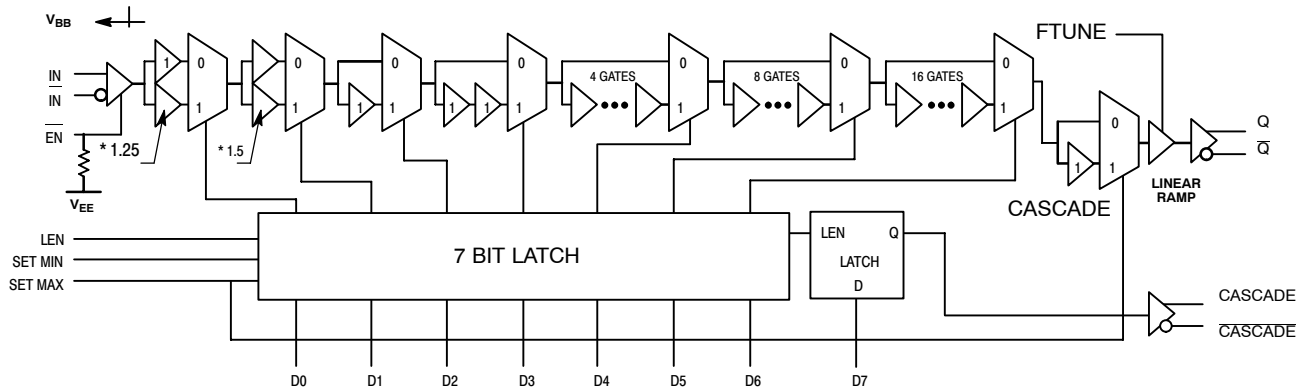
**Figure 1. Pinout: PLCC-28**  
(Top View)

**Table 1. PIN DESCRIPTION**

PIN	FUNCTION
IN/ $\bar{IN}$	ECL Signal Input
$\bar{EN}$	ECL Input Enable (H Forces Q Low)
D[0:7]	ECL MUX Select Inputs
Q/ $\bar{Q}$	ECL Signal Output
LEN	ECL Latch Enable
SET MIN	ECL Min Delay Set
SET MAX	ECL Max Delay Set
CASCADE	ECL Cascade Signal
FTUNE	ECL Linear Voltage Input
V <sub>BB</sub>	Reference Voltage Output
V <sub>CC</sub> , V <sub>CCO</sub>	Positive Supply
V <sub>EE</sub>	Negative Supply
NC	No Connect

**Table 2. TRUTH TABLE**

$\bar{EN}$	L	Q = IN
$\bar{EN}$	H	Q Logic Low
LEN	L	Pass Through D[0:10]
LEN	H	Latch D[0:10]
SETMIN	L	Normal Mode
SETMIN	H	Min Delay Path
SETMAX	L	Normal Mode
SETMAX	H	Max Delay Path



\* delays are 25% or 50% longer than standard (standard  $\approx$  80 ps)

**Figure 2. Logic Diagram – Simplified**

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**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		8	V
V <sub>EE</sub>	NECL Mode Power Supply	V <sub>CC</sub> = 0 V		-8	V
V <sub>I</sub>	PECL Mode Input Voltage NECL Mode Input Voltage	V <sub>EE</sub> = 0 V V <sub>CC</sub> = 0 V	V <sub>I</sub> ≤ V <sub>CC</sub> V <sub>I</sub> ≥ V <sub>EE</sub>	6 -6	V V
I <sub>out</sub>	Output Current	Continuous Surge		50 100	mA mA
I <sub>BB</sub>	V <sub>BB</sub> Sink/Source			± 0.5	mA
T <sub>A</sub>	Operating Temperature Range			0 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 500 lfpm	PLCC-28 PLCC-28	63.5 43.5	°C/W °C/W
θ <sub>JC</sub>	Thermal Resistance (Junction-to-Case)	Standard Board	PLCC-28	22 to 26	°C/W
V <sub>EE</sub>	PECL Operating Range NECL Operating Range			4.2 to 5.7 -5.7 to -4.2	V V
T <sub>sol</sub>	Wave Solder Pb Pb-Free			265 265	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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**Table 4. 10E SERIES PECL DC CHARACTERISTICS**  $V_{CCx} = 5.0\text{ V}$ ;  $V_{EE} = 0.0\text{ V}$  (Note 1)

Symbol	Characteristic	0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Power Supply Current		130	156		130	156		130	156	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 (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		3.74	3.65		3.75	3.69		3.81	V
$V_{IHCMR}$	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 3)	2.2		4.6	2.2		4.6	2.2		4.6	V
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5	0.3		0.5	0.25		0.3	0.2		$\mu\text{A}$

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. 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  $-0.46\text{ V} / +0.06\text{ V}$ .
2. Outputs are terminated through a  $50\ \Omega$  resistor to  $V_{CC} - 2.0\text{ V}$ .
3.  $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ , max varies 1:1 with  $V_{CC}$ .

**Table 5. 10E SERIES NECL DC CHARACTERISTICS**  $V_{CCx} = 0.0\text{ V}$ ;  $V_{EE} = -5.0\text{ V}$  (Note 4)

Symbol	Characteristic	0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Power Supply Current		130	156		130	156		130	156	mA
$V_{OH}$	Output HIGH Voltage (Note 5)	-1020	-930	-840	-980	-895	-810	-910	-815	-720	mV
$V_{OL}$	Output LOW Voltage (Note 5)	-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 6)	-2.8		-0.4	-2.8		-0.4	-2.8		-0.4	V
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5	0.3		0.5	0.065		0.3	0.2		$\mu\text{A}$

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. 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.

4. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary  $-0.46\text{ V} / +0.06\text{ V}$ .
5. Outputs are terminated through a  $50\ \Omega$  resistor to  $V_{CC} - 2.0\text{ V}$ .
6.  $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ , max varies 1:1 with  $V_{CC}$ .

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**Table 6. 100E SERIES PECL DC CHARACTERISTICS**  $V_{CCx} = 5.0\text{ V}$ ;  $V_{EE} = 0.0\text{ V}$  (Note 7)

Symbol	Characteristic	0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Power Supply Current		130	156		130	156		150	179	mA
$V_{OH}$	Output HIGH Voltage (Note 8)	3975	4050	4120	3975	4050	4120	3975	4050	4120	mV
$V_{OL}$	Output LOW Voltage (Note 8)	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 9)	2.2		4.6	2.2		4.6	2.2		4.6	V
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5	0.3		0.5	0.25		0.5	0.2		$\mu\text{A}$

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. 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.

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

8. Outputs are terminated through a  $50\ \Omega$  resistor to  $V_{CC} - 2.0\text{ V}$ .

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

**Table 7. 100E SERIES NECL DC CHARACTERISTICS**  $V_{CCx} = 0.0\text{ V}$ ;  $V_{EE} = -5.0\text{ V}$  (Note 10)

Symbol	Characteristic	0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Power Supply Current		130	156		130	156		150	179	mA
$V_{OH}$	Output HIGH Voltage (Note 11)	-1025	-950	-880	-1025	-950	-880	-1025	-950	-880	mV
$V_{OL}$	Output LOW Voltage (Note 11)	-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 12)	-2.8		-0.4	-2.8		-0.4	-2.8		-0.4	V
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5	0.3		0.5	0.25		0.5	0.2		$\mu\text{A}$

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. 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.

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

11. Outputs are terminated through a  $50\ \Omega$  resistor to  $V_{CC} - 2.0\text{ V}$ .

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

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**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 13)

Symbol	Characteristic	0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$f_{MAX}$	Maximum Toggle Frequency					>1.0					GHz
$t_{PLH}$ $t_{PHL}$	Propagation Delay IN to Q; Tap = 0 IN to Q; Tap = 127 EN to Q; Tap = 0 D7 to CASCADE	1210 3320 1250 300	1360 3570 1450 450	1510 3820 1650 700	1240 3380 1275 300	1390 3630 1475 450	1540 3880 1675 700	1440 3920 1350 300	1590 4270 1650 450	1765 4720 1950 700	ps
$t_{RANGE}$	Programmable Range $t_{PD}(\text{max}) - t_{PD}(\text{min})$	2000	2175		2050	2240		2375	2580		ps
$\Delta t$	Step Delay (Note 14) D0 High D1 High D2 High D3 High D4 High D5 High D6 High		17 34 68 136 272 544 1088			17.5 35 70 140 280 560 1120			21 42 84 168 336 672 1344	120 205 380 740 1450	ps
Lin	Linearity (Note 15)	D1	D0		D1	D0		D1	D0		
$t_{SKEW}$	Duty Cycle Skew $t_{PHL} - t_{PLH}$ (Note 16)		±30			±30			±30		ps
$t_{JITTER}$	Random Clock Jitter (RMS)		< 5			< 5			< 5		ps
$t_s$	Setup Time D to LEN D to IN (Note 17) EN to IN (Note 18)	200 800 200	0		200 800 200	0		200 800 200	0		ps
$t_h$	Hold Time LEN to D IN to EN (Note 19)	500 0	250		500 0	250		500 0	250		ps
$t_R$	Release Time EN to IN (Note 20) SET MAX to LEN SET MIN to LEN	300 800 800			300 800 800			300 800 800			ps
$t_{jit}$	Random Clock Jitter (RMS)		< 5			< 5			< 5		ps
$t_r$ $t_f$	Output Rise/Fall Time 20–80% (Q) 20–80% (CASCADE)	125 300	225 450	325 650	125 300	225 450	325 650	125 300	225 450	325 650	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. 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.

13. 10 Series:  $V_{EE}$  can vary  $-0.46\text{ V} / +0.06\text{ V}$ .

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

14. Specification limits represent the amount of delay added with the assertion of each individual delay control pin. The various combinations of asserted delay control inputs will typically realize D0 resolution steps across the specified programmable range.

15. The linearity specification guarantees to which delay control input the programmable steps will be monotonic (i.e. increasing delay steps for increasing binary counts on the control inputs Dn). Typically the device will be monotonic to the D0 input, however under worst case conditions and process variation, delays could decrease slightly with increasing binary counts when the D0 input is the LSB. With the D1 input as the LSB the device is guaranteed to be monotonic over all specified environmental conditions and process variation.

16. Duty cycle skew guaranteed only for differential operation measured from the cross point of the input to the cross point of the output.

17. This setup time defines the amount of time prior to the input signal the delay tap of the device must be set.

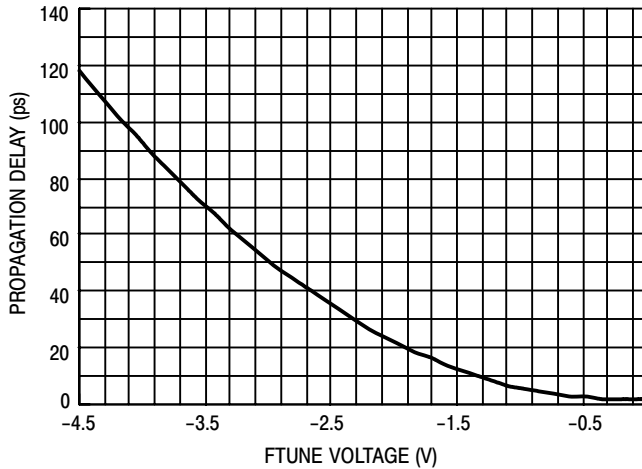
18. This setup time is the minimum time that EN must be asserted prior to the next transition of IN/IN to prevent an output response greater than ±75 mV to that IN/IN transition.

19. This hold time is the minimum time that EN must remain asserted after a negative going IN or positive going IN to prevent an output response greater than ±75 mV to that IN/IN transition.

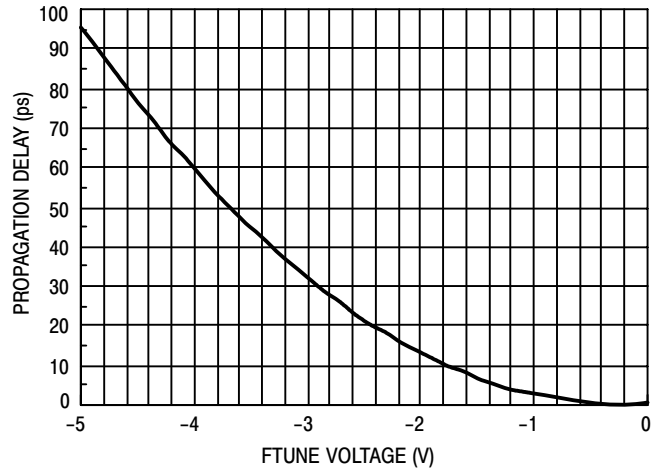
20. This release time is the minimum time that EN must be de-asserted prior to the next IN/IN transition to ensure an output response that meets the specified IN to Q propagation delay and transition times.

**ANALOG INPUT CHARACTERISTICS**

FTUNE =  $V_{CC}$  to  $V_{EE}$



**Propagation Delay versus FTUNE Voltage (100E196)**



**Propagation Delay versus FTUNE Voltage (10E196)**

**USING THE FTUNE ANALOG INPUT**

The analog FTUNE pin on the E196 device is intended to add more delay in a tunable gate to enhance the 20 ps resolution capabilities of the fully digital E195. The level of resolution obtained is dependent on the number of increments applied to the appropriate range on the FTUNE pin.

To provide this further level of resolution (See Logic Diagram), the FTUNE pin must be capable of adjusting the additional delay finer than the 20 ps digital resolution. From the provided graphs one sees that this requirement is easily achieved as over the entire FTUNE voltage range a 100 ps additional delay can be achieved. This extra analog range ensures that the FTUNE pin will be capable even under worst case conditions of covering the digital resolution. Typically the analog input will be driven by an external DAC to provide a digital control with very fine analog output steps. The final resolution of the device will be dependent on the width of the DAC chosen.

To determine the voltage range necessary for the FTUNE input, the graphs provided should be used. As an example if a tuning range of 40 ps is selected to cover worst case conditions and ensure coverage of the digital range, from the 100E196 graph a voltage range of -3.25 V to -4.0 V would be necessary on the FTUNE pin. Obviously there are numerous voltage ranges which can be used to cover a given delay range, users are given the flexibility to determine which one best fits their designs.

**Cascading Multiple E196's**

To increase the programmable range of the E196 internal cascade circuitry has been included. This circuitry allows for the cascading of multiple E196's without the need for any external gating. Furthermore this capability requires only

one more address line per added E196. Obviously cascading multiple PDC's will result in a larger programmable range, however, this increase is at the expense of a longer minimum delay.

Figure 3 illustrates the interconnect scheme for cascading two E196's. As can be seen, this scheme can easily be expanded for larger E196 chains. The D7 input of the E196 is the cascade control pin. With the interconnect scheme of Figure 3 when D7 is asserted it signals the need for a larger programmable range than is achievable with a single device.

An expansion of the latch section of the block diagram is pictured below. Use of this diagram will simplify the explanation of how the cascade circuitry works. When D7 of chip #1 above is low the cascade output will also be low while the cascade bar output will be a logical high. In this condition the SET MIN pin of chip #2 will be asserted and thus all of the latches of chip #2 will be reset and the device will be set at its minimum delay. Since the RESET and SET inputs of the latches are overriding any changes on the A0-A6 address bus will not affect the operation of chip #2.

Chip #1 on the other hand will have both SET MIN and SET MAX de-asserted so that its delay will be controlled entirely by the address bus A0-A6. If the delay needed is greater than can be achieved with 31.75 gate delays (111111 on the A0-A6 address bus) D7 will be asserted to signal the need to cascade the delay to the next E196 device. When D7 is asserted the SET MIN pin of chip #2 will be de-asserted and the delay will be controlled by the A0-A6 address bus. Chip #1 on the other hand will have its SET MAX pin asserted resulting in the device delay to be independent of the A0-A6 address bus.

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When the SET MAX pin of chip #1 is asserted the D0 and D1 latches will be reset while the rest of the latches will be set. In addition, to maintain monotonicity an additional gate delay is selected in the cascade circuitry. As a result when D7 of chip #1 is asserted the delay increases from 31.75 gates to 32 gates. A 32 gate delay is the maximum delay setting for the E196.

When cascading multiple PDC's it will prove more cost effective to use a single E196 for the Most Significant Bit (MSB) of the chain while using E195 for the lower order bits. This is due to the fact that only one fine tune input is needed to further reduce the delay step resolution.

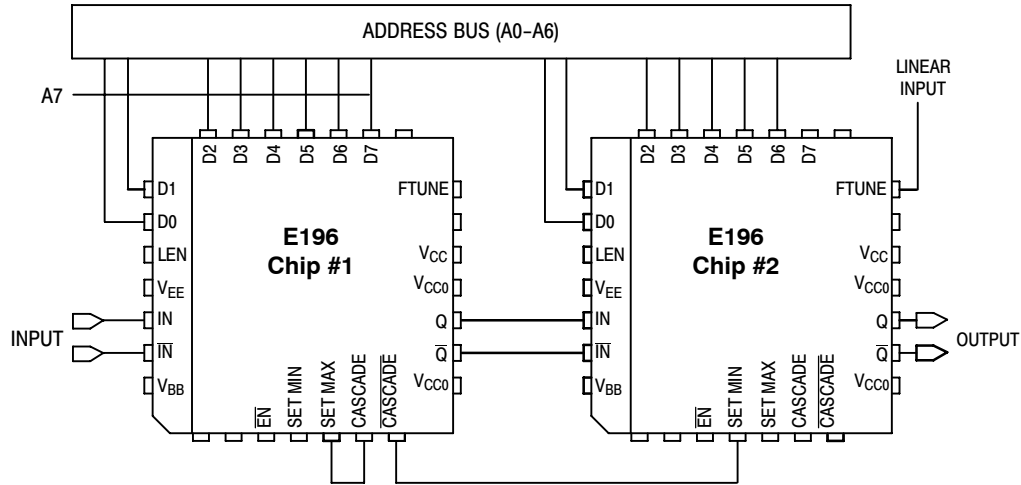


Figure 3. Cascading Interconnect Architecture

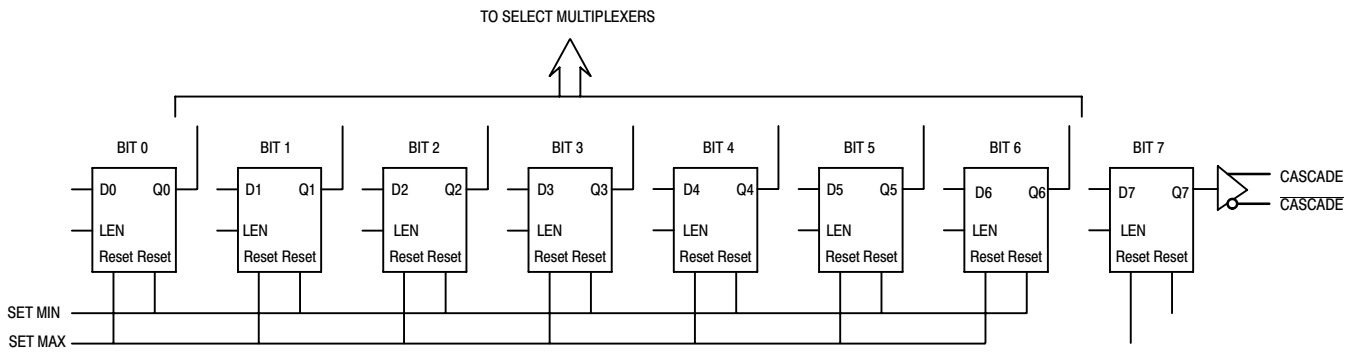
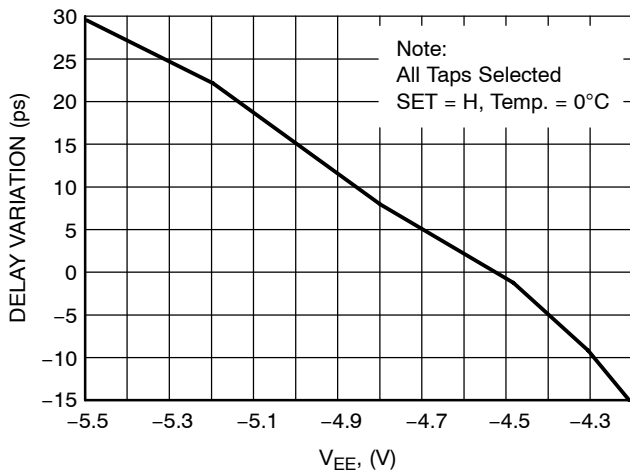
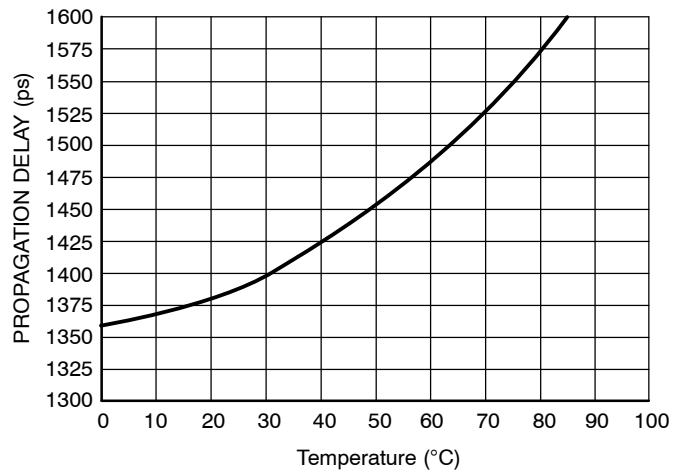


Figure 4. Expansion of the Latch Section of the E196 Block Diagram

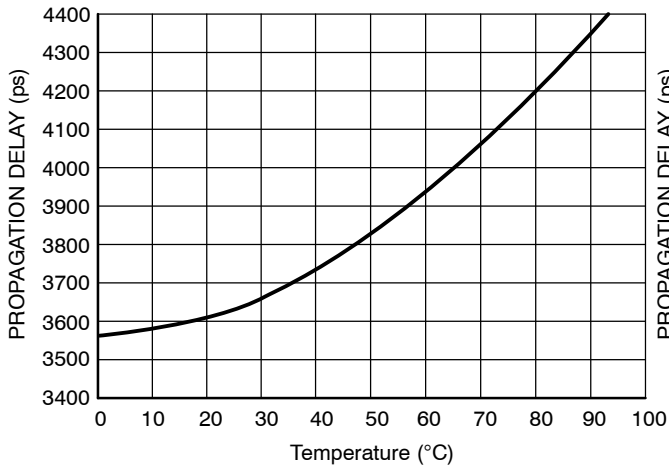
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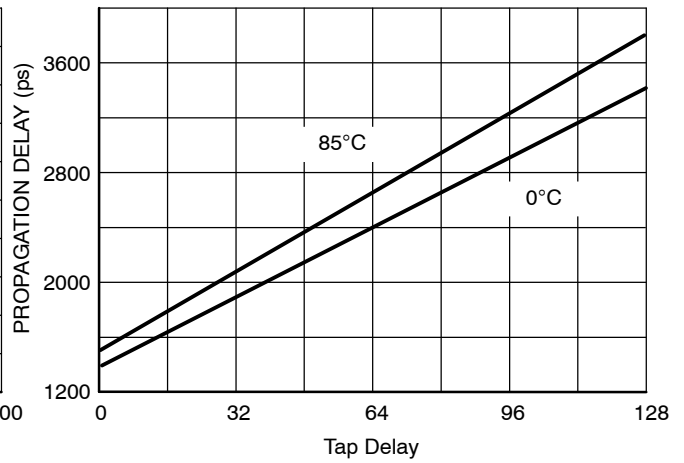
**Figure 5. Change in Delay vs. Change in Supply Voltage**



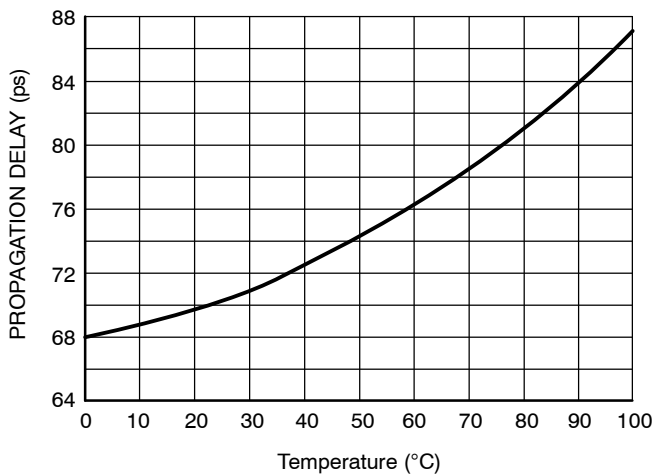
**Figure 6. Delay vs. Temperature (Fixed Path)**



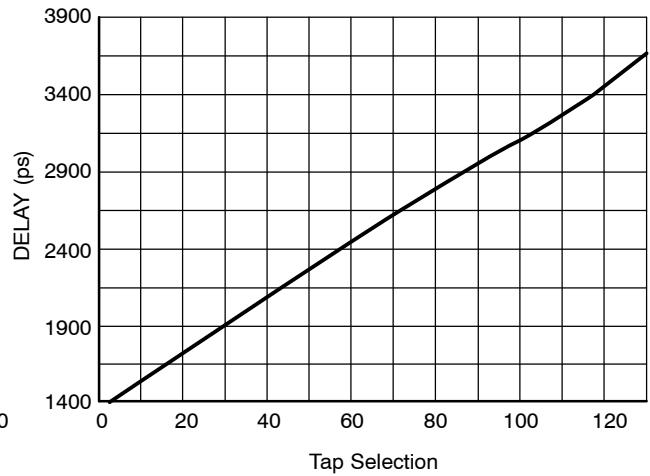
**Figure 7. Delay vs. Temperature (Max. Delay).**



**Figure 8. 100E196 Temperature Effects on Delay.**

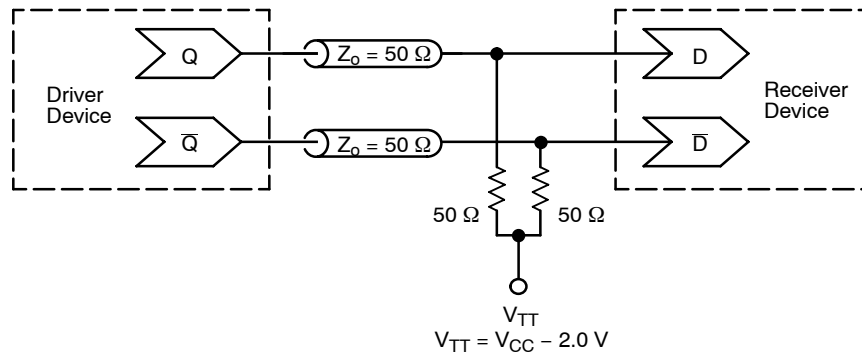


**Figure 9. Delay vs. Temperature (Per Gate).**



**Figure 10. E195 Delay Linearity.**

## MC10E196, MC100E196



**Figure 11. Typical Termination for Output Driver and Device Evaluation  
(See Application Note AND8020/D – Termination of ECL Logic Devices.)**

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
MC10E196FN	PLCC-28	37 Units / Rail
MC10E196FNG	PLCC-28 (Pb-Free)	37 Units / Rail
MC10E196FNR2	PLCC-28	500 / Tape & Reel
MC10E196FNR2G	PLCC-28 (Pb-Free)	500 / Tape & Reel
MC100E196FN	PLCC-28	37 Units / Rail
MC100E196FNG	PLCC-28 (Pb-Free)	37 Units / Rail
MC100E196FNR2	PLCC-28	500 / Tape & Reel
MC100E196FNR2G	PLCC-28 (Pb-Free)	500 / 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.

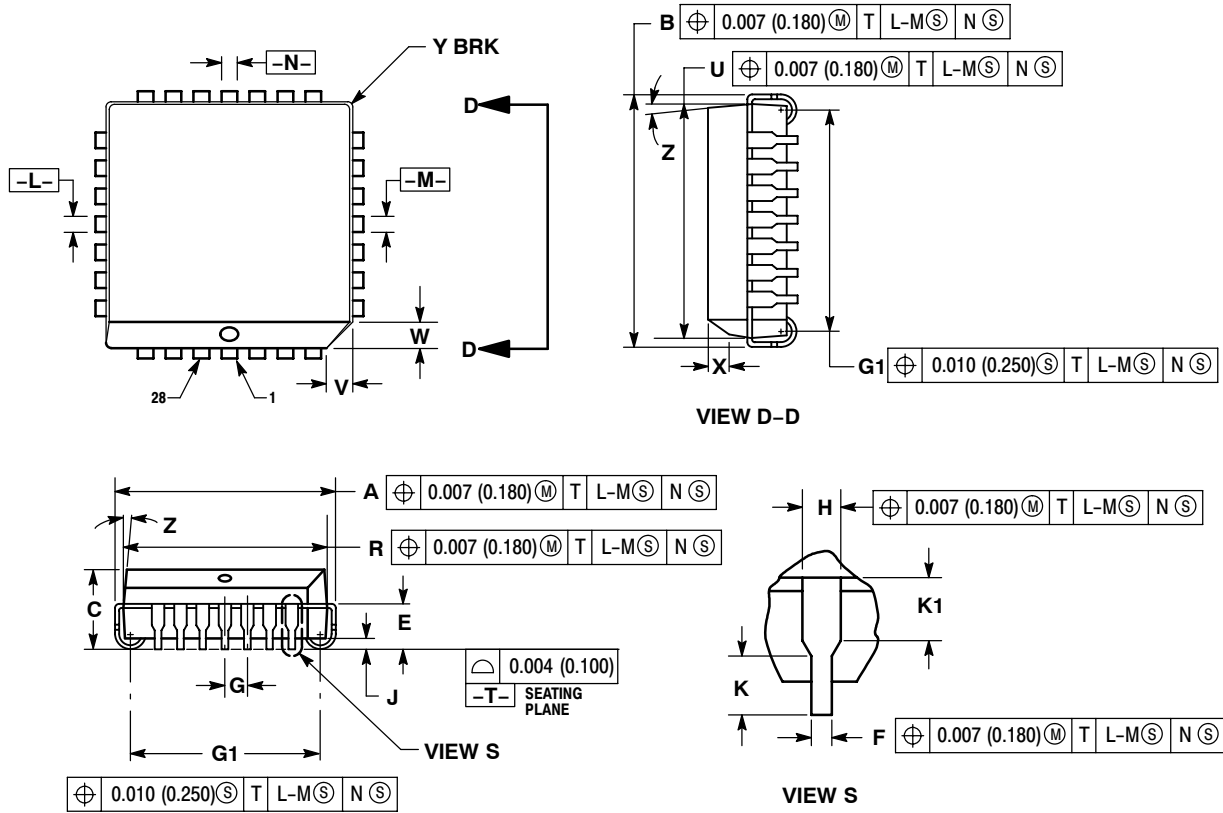
#### Resource Reference of Application Notes

- 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
- AN1672/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

# MC10E196, MC100E196

## 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.
- 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 BOTTOM MAY BE SMALLER THAN THE PACKAGE TOP 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°	
G1	0.410	0.430	10.42	10.92
K1	0.040	---	1.02	---

# MC10E196, MC100E196

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